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Power for Industry

ELECTRIFICATION AND PRODUCTIVITY

ATTEMPTS to draw industrial comparisons between Great Britain and the United States can never result in anything better than estimates, or just guesses, because of the lack of adequate, up-to-date, reliable and comparable statistics. It might be said that they are merely endeavours to make bricks with straws in the wind. Mr. C. T. Melling, chairman of the I.E.E. Utilization Section, came up against this in preparing his address in which he deals with the essential part played by electricity in industrial production.

Methods of Comparison

It is axiomatic that the amount of electric power used is an index to productivity. What is not exact, however much it may be so regarded, is that the h.p. per worker is a measure of production. American workers may have at their disposal two or three times the amount of electrical equipment available to their British counterparts but, as Mr. Melling shows, it does not follow that it is used to the full extent. Nor is it clear what the word "worker" implies; all employees are not operatives and it is operatives who use the machines.

Again, the total industrial load is not a firm basis of comparison. In this country the position has been somewhat disguised by load spreading and by the installation of private plant, measures to counteract the effects of inadequate power resources.

Industrial electrical progress can best be gauged by power consumption, although in this case, too, the output of private plant is an unknown quantity. Making allowance for this, it appears that the consistent rise in sales of industrial power, culminating in the wartime peak, has been checked but it must be resumed if this country is to keep ahead of its competitors who are now showing signs of great activity.

There is no doubt that this check has been caused not only by the shortage of generating plant, which of itself has slowed down factory conversion schemes, but by the fear of manufacturers that too great dependence upon electricity in present circumstances may result in stoppages of production.

Effects of Government Policy

It is not yet certain that the Government realizes that nowadays industrial progress is synonymous with electrification. Even if it does, past decisions to cut down expenditure on generating plant are still exercising their evil influence. One serious effect of these decisions was that manufacturers of equipment were afraid to expand their works too far lest they should find themselves saddled with superfluous capacity, imposing unrequited "overheads" upon their production costs. Actually there is likely to be an ever-increasing demand in the foreseeable future if the Government does not pursue a mistaken policy.

Mr. Melling reminded members of the Section that it was their duty to develop all aspects of utilization but he had to take account of the limitation imposed

by the generating plant shortage. He put forward the suggestion that we have heard several times recently that if necessary we should purchase from abroad "those portions of the power station plant the lack of which is retarding the British Electricity Authority's programme." This relates to the steam side where there is an acute shortage of tubes and pipework, coupled with a lack of draughtsmen and erectors. There has been no hint that the capacity for producing generating plant is inadequate.

Cuts in capital expenditure are again in the air. It is to be hoped that the Government has come to a realization that electricity is the vital force in productive industry and that it will not seek to limit the provision of power plant and the electrification of factories.

OPEN DISCUSSION

EVER since the nationalization of the electricity supply industry it has been the practice of the South Eastern Electricity Board to hold half-yearly meetings with manufacturers' representatives. By this means some indication of the Board's buying policy and methods is given and the manufacturers are able to put forward suggestions and ask pertinent questions. Some of the proposals have been adopted and most of the questions have been answered. While there may occasionally be a hint of the firm hand within the velvet glove it is believed that these meetings are of value as establishing more intimate and friendly relations between the two parties. Other Boards may prefer to meet manufacturers one by one in private but there is much to be said for open meetings; members of other branches of the electrical industry know too little of the Boards' intentions.

THE CONTRACTORS' CASE

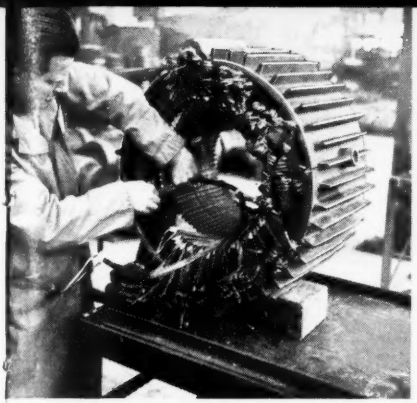
THE strengthened competition in installation work of the electricity supply industry necessitates corresponding action on the part of the private electrical contractors if they are to survive. Action can be more effective if taken in combination and the Electrical Contractors' Association is accordingly providing its members with the necessary ammunition from headquarters. Using the expression "The Third Link" to signify the contractors' position in relation to generation and distribution of electricity, the Association has produced a pamphlet setting forth its origins, history and achievements and recommending to the public the services of its members. With it is a leaflet, containing a briefer statement, which is arranged for overprinting the names of individual contractors or firms. We are pleased to see that there is no direct attack on the Electricity Boards, although stress is laid on the fact that the private contractor pays his own way and his activities are in no way a charge on rates or taxes.

FREEDOM OF TRADE

So complicated are the twenty-eight schedules annexed to the protocol agreed at Annecy (Switzerland) earlier this year, and now published, that an assessment of their effects upon the electrical industry is not easy to make. Thirty-three countries are involved in the agreements which aim at removing quota restrictions, reducing import duties in some cases and maintaining the present rates in others. Generally speaking British concessions relate to imports of raw materials and should thus be mainly beneficial. Concessions gained by this country are largely in respect of manufactured goods and this, again, will ostensibly be to our advantage.

CO-ORDINATION AGAIN

FROM time to time somebody or other in the coal or gas industries calls for "co-ordination" of the fuel services and we shudder for what is usually meant is subordination of the electricity supply industry. The matter is again raised by Dr. E. A. C. Chamberlain, a National Coal Board official, who is reported by the *Scotsman* to have said recently that the nationalization of the fuel industries had not produced any indication of a co-ordinated and planned fuel policy. "I cannot help feeling," he said, "that in spite of the good that may arise from competition, the whole position requires a national integration plan if our diminishing fuel resources are to be used to the best advantage." To which the reply of the electricity supply industry is: "Continue to give us the coal, largely of types unusable otherwise, and we will use it to the best advantage."



Winding the stator of a 55 h.p. totally enclosed fan-cooled motor, one of a batch for Finland

Motor Manufacture

Flow Production Methods at a New Cardiff Factory

ALTHOUGH the history of the Hopkinson Electric Co., Ltd., extends back over more than sixty years, the company cannot be accused of being behind the times in its outlook. Its extensive new factory opened two years ago at Birchgrove, Cardiff, is one of the most up to date in the country and the whole layout and methods adopted have been carefully planned to eliminate as far as possible unnecessary movement and so secure maximum output.

To understand how this large new enterprise has been brought to South Wales to give employment to some hundreds of men and women it is necessary to know something of the development of the organization. It was in the 'eighties that Walter Langdon-Davies first began experimenting with a.c. motors and this led to the formation of the Langdon Davies Motor Company in 1888. Three years later the first single-phase motor, now in the Science Museum, South Kensington, was put on the market.

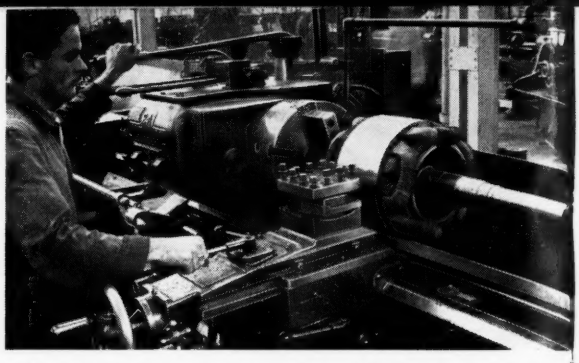
Until 1912 the company occupied the Southwark Works, Deverall Street, S.E. It then moved to a small building in Dermody Road, Lewisham, which until recently was used by the Hopkinson Electric Co. as its London depot. On Mr. Langdon-Davies's retirement in 1916 the company was sold to Mr. Brittain and remained Brittain's Electric Motor Co.

In 1920 Mr. E. Hopkinson-Smith and Mr. Norman Pogson went into partnership as "Hopkinson Induction Motors" and began production in Fulham. Works were later built at North Acton where the business was built up and extended until by 1939 the factory covered an area of about 12,000 sq ft. Mr. Hopkinson-Smith and Mr. Pogson retired in 1941 and sold their business to the Philco Radio and Television Corporation of Gt. Britain, Ltd. (now the Radio and

Flow production has been developed to a large extent in the stator winding section where the smaller types of motors are manufactured

Television Trust, Ltd.).

The business was then converted into a company and renamed the Hopkinson Motors and Electric Co., Ltd. Following a steady policy of progress and development the company sought opportunities for improvement and extension and in 1943 Brittain's Electric Motor Co. was absorbed and additional factories were opened in Kilburn, Carlton Vale and Catford. The name of the company was changed to the Hopkinson Electric Co., Ltd., in 1947.



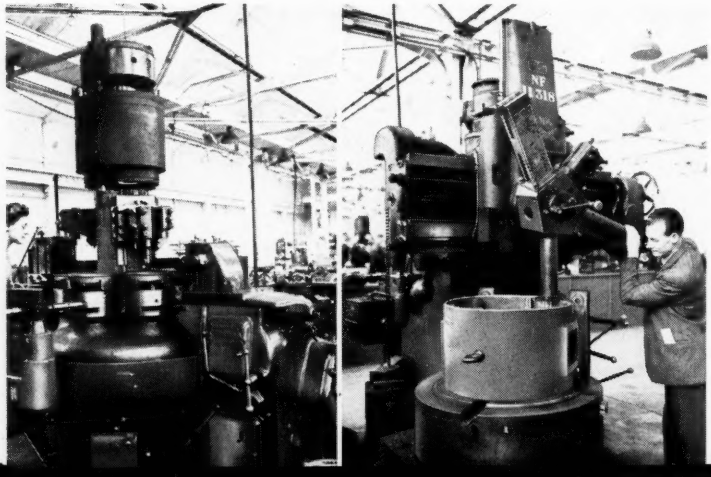
Finish turning of a 45 h.p. slip-ring rotor at the Birchgrove (Cardiff) works

At the end of the war the Board of Trade was approached for permission to build a factory in the London area of a type and size suitable for the company's expansion programme. Owing, however, to Government policy and building and labour difficulties, the company was persuaded to choose a site in Caerphilly Road, Birchgrove, Cardiff, and in 1946 work was started on a factory designed by Sir Percy Thomas, past president of the Royal Society of British Architects.

The scheme provides ultimately for a floor space of over 400,000 sq ft. About 120,000 sq ft is already in use and a separate administrative block of 40,000 sq ft is nearing completion. The factory itself is rectangular and each work bay is 300ft long by 25ft wide with 15ft clear head room under the roof trusses. Production is planned on a continuous-flow system. The raw materials enter the factory at one corner where they are all carefully inspected before going into store, and the various components as built up pass automatically across and down the factory until they finally reach the assembly lines and the conveyor which takes the finished products to the despatch department at the far end of the factory.

Among the up-to-date production equipment used the multi-head borers enable endshields to be machined throughout at one setting except for the finishing of the bearing housing bore which is done on fine-boring machines, thus ensuring a very high degree of accuracy for the fit of the ball-race. Stators are machined on vertical borers to very close tolerances. Laminations up to about 9in diameter are produced by combination-type tools in the press shop. In the winding department every individual coil is checked against a master coil before assembly to ensure the correct number of turns and size of wire, the wound stator or rotor afterwards being checked to ensure correct phase balance.

All connections between the stator coils are made by fusing, thus ensuring perfect contact



Multi-head automatic borers enable five separate machining operations to be carried out on the endshields and (right) boring a large stator frame casting

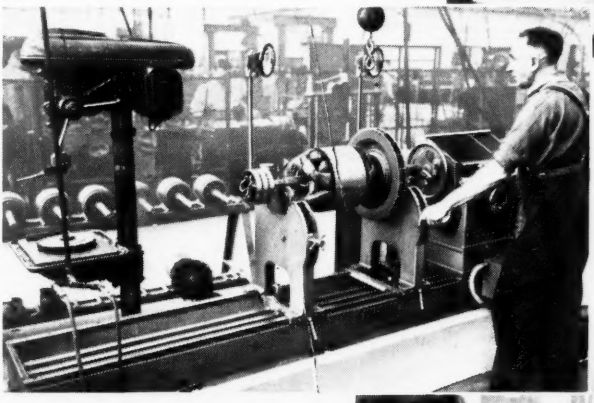
throughout the life of the motor. A high-frequency heater, made by the company's associate, Airmec Laboratories, Ltd., is used for soldering the leads on to commutators for repulsion-induction motors. All stators and rotors are impregnated with a tropical thermal-setting varnish so that standard motors are suitable for operation in any part of the world. Rotors are dynamically balanced on Gisholt and Avery machines in order to obtain quiet and vibrationless running, together with minimum bearing wear. Grinding of the rotor shafts is carried out to very fine limits.

Test enclosures are located at the end of each of the assembly lines for production tests, after which slat conveyors take the motors to the paint spray booths. Special tests are carried out in a separate main test enclosure, an electronic surge-tester being among the apparatus available.

The standard range of industrial polyphase motors extends from ¼ h.p. to 150 h.p. Slip-ring motors are made in the same frame sizes from 1 h.p. upwards. Single-phase motors are now built for various duties and in sizes up to 60 h.p. for slip-ring, 5 h.p. for repulsion-induction, 1 h.p. for capacitor-start-induction run, and ½ h.p. for split-phase. Large numbers of totally enclosed fan-cooled motors are now being made, the largest on order being 60 h.p. Stocks have been built up of squirrel-cage units up to 30 h.p., slip-ring types up to 25 h.p. and totally enclosed fan-cooled up to 20 h.p.

Plans are in hand for making a range

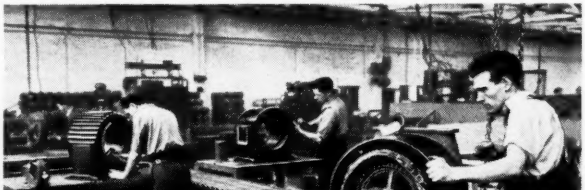
High-frequency heater for soldering the leads on to commutators (above)



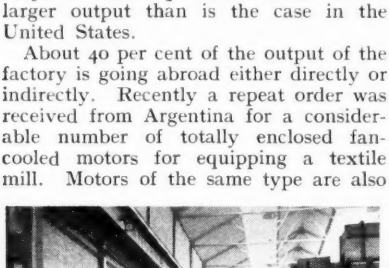
All rotors are dynamically balanced, the larger sizes on an Avery machine and the smaller ones on a Gisholt electronic device

of flameproof units, and facilities are available for building special types of motors to customers' requirements. We saw several 120 h.p. machines and 100 h.p. eight-pole units in course of construction during a recent visit. Even in special motors standardized components have been employed to the utmost. It is a matter of interest to note that a number of frame sizes in the Hopkinson range conform to the American National Electrical Manufacturers' Association's dimensions except that the motor incorporated in a particular frame has a larger output than is the case in the United States.

About 40 per cent of the output of the factory is going abroad either directly or indirectly. Recently a repeat order was received from Argentina for a considerable number of totally enclosed fan-cooled motors for equipping a textile mill. Motors of the same type are also going to Finland. Another interesting recent order received is for machines of the flange-mounted type for Pakistan.



Corner of the assembly department: 25 h.p. drip-proof machine in foregroun



Part of the despatch department. Motors packed for export are to be seen on the right

We wish to acknowledge the assistance of Commander C. F. Nock, the company's sales manager, Mr. R. H. Koller, works manager, and Mr. G. Redfern, chief engineer, in the preparation of this article.

Australian News

THE Governor-General, Mr. W. J. McKell, on Monday officially inaugurated work on the Snowy River hydro-electric scheme. Headquarters of the construction authority will be at Cooma, and shortly a road-making scheme for the area will be put into operation. Earth-moving equipment for the job may be brought in from Formosa and Hong Kong, as it is stated that the necessary machinery can be purchased in those Far Eastern centres for sterling.

Victorian Power Plans. — The Victorian State Electricity Commission is taking active steps to speed up power production, and by 1960 expects to spend at least £55,000,000 on its projects. At the moment the Yallourn power station generates the bulk of Victoria's electricity from raw brown coal. The Yallourn open cut, from which the brown coal is obtained, is situated in a huge coal field estimated to contain 6,000 million tons. Within the next six years it is proposed to operate two further open cuts the same size as the present one. Power generated at Yallourn is transmitted to Melbourne *via* a steel twin-tower 132 kV line.

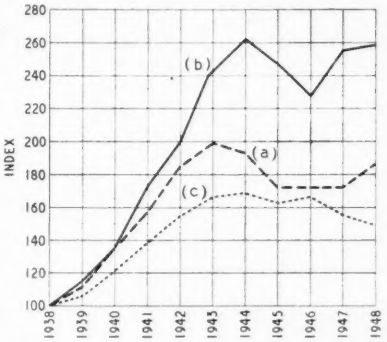
Electricity and Productivity

I.E.E. Utilization Section Chairman's Address

THE position of industrial electrification in this country, particularly as compared with the United States, and methods of extending it were considered by Mr. C. T. Melling (chairman of the Eastern Electricity Board) in his address as chairman of the Utilization Section of the Institution of Electrical Engineers last week.

Mr. Melling presented the well-known contrast between the h.p. per worker in Great Britain and America, but gave a warning that the usual comparison was not altogether a satisfactory one. In the United States there was a greater readiness to replace plant and even to "overmotorize" machines. Moreover, the greater employment of mass-production methods in the United States justified a greater specialization of tools than in a factory relying more on craftsmanship. This did not overlook the necessity here for greater adoption of mass-production methods.

For these reasons Mr. Melling preferred to consider the electricity consumed by industry, which was a clear indication of the prosperity of the country. Between 1921 and 1948 there had been a rapid increase in power sales; this itself formed an adequate answer to those holding pessimistic views on the country's progress. The speaker traced the course of the curve during that period and showed that since the war the increase had not so far followed the previous trend. It was therefore evident that the industrial use of electricity must increase materially if we were to maintain the same rate of progress of industrial productivity as in the past and thus keep up our national prosperity and standard of living.



Index of electricity sold for power purposes.

(a) Great Britain. (b) United States. (c) Great Britain (per person employed)

He did not think that gloomy conclusions should be drawn from the curve, and there was hope that since the last figure (1947-48) there had been marked improvement. Moreover, the figures did not take account of the large amount of private generating plant which had been installed to meet the power shortage. There had also been economies in the use of electricity and more efficient use.

Utilization of electricity in industry in Great Britain and the United States was illustrated by curves (reproduced herewith) relating to 1938 figures (=100). From these has been derived the curve for the kWh consumed per employee, although consumption per operative employee, if it were available, would be a more accurate measure. Here Mr. Melling made a plea for improved international statistical methods.

The 1935 Census of Production gave a figure of industrial utilization (all trades) of about 1,250 kWh per employee; the corresponding figure for 1948 would be about 2,100 kWh. Although strict comparison is impossible, it is thought that the consumption per employee in the United States was about 7,000 kWh.

Again in the absence of strictly comparative figures, the output of manufactured goods per worker is a better measure of productivity. A recent publication showed that in the thirty years 1907-37 output per man-hour increased by about 65 per cent in the United Kingdom compared with 140 per cent in the

United States. Until 1920 the increases in the two countries were comparable.

The reasons for this difference were complex and it was clearly not the function of the Utilization Section to engage in any controversies which might arise in solving our productivity problems. It was equally clear that so far as electricity could provide a solution the Section must do its utmost to assist. Members collectively had an incomparable knowledge and experience of the possibilities of improving production by greater electrification. In their day-to-day work they were contributing to the solution of national difficulties and they could contribute even more by making available to other manufacturing concerns the benefits of their specialized experience. The problem was to bring the average and the worst plants up to the standard of the best.

There was also a need to increase the number of effective hours of use of modern productive machinery. Electricity could help to reduce time-waste on machine operations by quicker starting up, in conveyor systems, and other ways. Electrical operation and control made it possible to speed up production, and electricity could also help by improving amenities, particularly factory lighting.

Importance of Home Market

Increased electrical exports were essential, but there must also be a sound home market for utilization apparatus and appliances to give scope for extended manufacturing programmes. Members of the Section could contribute to this by developing, within the limit of present plant availability, all aspects of utilization, particularly those which required research and developments in manufacture which would place us ahead of our foreign competitors. In this respect the greater utilization of off-peak supplies was of value not only to the economy of this country, but in the improvement of the possibilities of exporting electrical appliances and apparatus.

The plant availability limit referred to called for every effort by the Government, the British Electricity Authority and the manufacturers. If necessary we should purchase abroad those portions of power-station plant the lack of which was retarding the B.E.A.'s programme.

Members could also contribute to industrial recovery by disseminating more information on modern factories, processes and techniques. Articles in the technical Press on modern factory installations, and papers read before the Institution and elsewhere on industrial electrification had stimulated interest in the possibilities of further improvements. He was aware that most of those who were best able to produce papers were already fully occupied, but he asked them to spare the time to prepare and read papers before the Utilization Section.

Industrial electrification was a continuing process and not merely a matter of re-equipment. It required constant vigilance in finding examples of the best practice and applying them elsewhere; of analysing existing processes and finding the electrical solutions of the component problems and applying them wherever practicable. The traditions and processes of industries were well established and an understanding of the particular industrial practice was therefore a first requirement of the improvement in productivity.

At all times the electrical engineer had the obligation to ensure that by simple explanation, training and guidance he was able to assist those to whom the new electrical tools were entrusted, so that the new technique would be welcomed and would benefit those in the factory as well as achieving a cheaper and better product.

Electricity Supply Handbook

THE third edition of the "Electricity Supply Handbook" just published by the *Electrical Times*, Sardinia House, Sardinia Street, W.C.2, price 3s 6d, contains 136 pp. compared with 88 pp. in the second edition and also includes a folding map of the B.E.A. Divisions. The details of personnel of the Boards have been considerably extended by the inclusion of many later appointments, particularly District officers. Lists of service centres have been added, together with data relating to the area, number of consumers, kWh sold, etc., in each District.

In the new edition the sections dealing with the Divisions are more appropriately placed immediately after the Central Authority. Useful statistics are also given with regard to the B.E.A.'s plant programme, bulk tariff, electricity output and sales, etc., and there is a list of the names and addresses of associations connected with the electrical industry.

Personal and Social

NEWS OF MEN AND WOMEN OF THE INDUSTRY

THE Leon Gaster Memorial Premium of the Illuminating Engineering Society has this year been awarded to **Dr. W. E. Harper** and **Mr. H. P. Walker** for their Paper entitled "Acrylic Plastics in Lighting," which was presented at the Society's Summer Meeting at Harrogate last year.

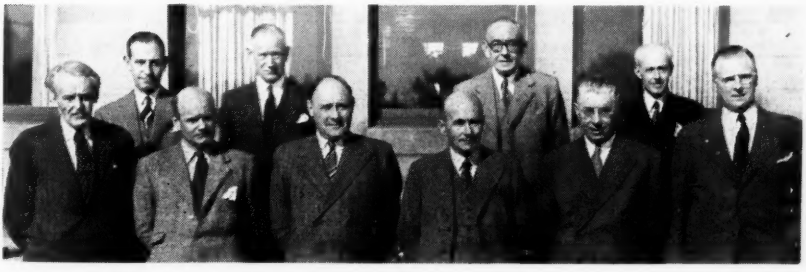
Dr. S. Whitehead, director of the British Electrical & Allied Industries Research Association, has been elected a vice-president of the Institute of Physics.

The General Electric Co., Ltd., announces the appointment of **Mr. A. O. Cosgrove,** B.Sc., M.I.E.E., as the company's resident engineer and general representative in British East Africa. Mr. Cosgrove will be responsible for looking after the interests of the company in Kenya, Uganda, Tanganyika, Zanzibar and Nyasaland in conjunction with the company's agents resident in these territories. Mr. Cosgrove, who is at present in England, will be returning to Nairobi at the end of the year to commence his new duties. He is well-known in East Africa where, for many years, he was the electrical engineer to the Kenya Government. He was recently chief electrical engineer to the Uganda Electricity Board established in January, 1948, to construct and operate the Owen Falls hydro-electric scheme on the River Nile near Jinja.

In our last issue we referred to the visit of the members of the Council of the **Electrical Wholesalers' Federation** to Gleneagles. We now reproduce a photograph of the Council taken outside the Gleneagles Hotel. Mr. A. C. Baker, of Bristol, who was indisposed, was the only absentee.

Mr. H. R. C. White, A.M.I.E.E., the South Western Electricity Board's Sub-Area engineer for Cornwall, has been nominated a member of the productivity team representing the supply industry, which leaves England on 22nd October for a six weeks' visit to America. This team, the first representing a nationalized industry, is sponsored by the Anglo-American Council on Productivity, and the purpose of its tour of installations in the United States is to study American methods and practices and to see how far these can be profitably applied to the supply industry in Britain. The outward journey will be made in the *Queen Mary*, and the party will return to England on 10th December in the *Queen Elizabeth*. During their stay in America they expect to visit Washington and to be received there by the Vice-President of the United States. Mr. White, who has been associated with electricity supply in Corn-

Mr. H. R. C. White



Members of the Council of the Electrical Wholesalers' Federation at Gleneagles

Back row, left to right: Messrs. G. W. Cartwright, Glasgow; W. H. Swain, Manchester; W. J. Bensley, London; and A. Glenister, Glasgow. Front row: A. B. Wildsmith, Director; C. Hall Marr, Newcastle; J. M. Mollander, Coventry; J. W. E. Rutherford, President, Newcastle; H. Riley, Sheffield; and E. A. V. Peckham, London.

wall for more than twenty years, will make a special study of the problems of rural electrification in the United States.

Mr. H. P. Sale, who has taken up duties as deputy sales manager with M. K. Electric, Ltd., as from 1st September last, was formerly chief technical representative with Enfield Rolling Mills, Ltd., Brimsdown, Middlesex. While with Enfield Rolling Mills he was responsible for the introduction of tellurium copper to the electrical industry at home and abroad, and also for the marketing of special alloys for electrical contacts and resistance welding electrodes.

Mr. H. P. Sale

Following the retirement of **Mr. G. W. Edward,** the Ship Carbon Co. of Great Britain, Ltd., has elected **Mr. C. H. Champion** as chairman of the company. **Mr. H. C. Stringer** and **Mr. R. S. Silman** have been appointed joint managing directors. The distribution and sale of the products of the Ship Carbon Co., are directed by Charles H. Champion & Co., Ltd., of which Mr. C. H. Champion remains chairman. Mr. H. C. Stringer is now managing director, and Mr. R. S. Silman is a director.

Lord Killearn has joined the board of Siemens Brothers & Co., Ltd.

The Belmos Co., Ltd., Bellshill, Lanarkshire, announces that **Mr. R. T. Lythall,** M.I.E.E., M.Amer.I.E.E., a director of the company, will, as from 1st November, represent it in London and the South with headquarters at the new office in Columbia House, Aldwych, London, W.C.2 (telephone Holborn 7676).

Dr. P. Dunsheath was last week installed as Chairman of Convocation of the University of London by the Chancellor, the Earl of Athlone.

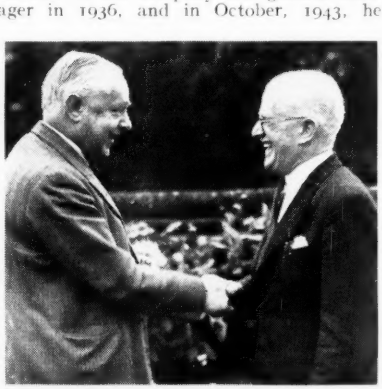
Mr. D. G. Mitchell, president of Sylvania Electric Products, Inc., U.S.A., has been elected to the board of Thorn Electrical Industries, Ltd. Sylvania Electric Products, Inc., were one of the pioneers of fluorescent development in the United States and are now one of the largest manufacturers of fluorescent lighting fixtures.

Mr. E. C. Neate, B.Sc.(Eng.), M.I.E.E., director of Riley & Neate, Ltd., electrical and civil engineers, Winchester, has been selected as prospective Labour candidate for the Farnham Division. He has served as vice-chairman of the Southern Centre of the I.E.E. and has been a member of Winchester City Council since 1945.

Mr. N. A. W. Le Grand has been appointed secretary of the British Welding Research Association, following the resignation of **Mr. A. Barker,** who has joined the staff of the British Boot & Shoe Manufacturers' Association. Mr. Le Grand has been secretary and commercial administrator to J. D. P. Wheatley & Co. and a group of associated property and investment companies.

The recent retirement of **Councillor W. H. Maicolm,** from the position of assistant general manager of the General Electric Co.'s telephone works at Copeswood, Coventry, after forty-nine years' service, was marked last week when a television set and a cheque contributed to by all employees at the works, was presented to him by Mr. D. E. Robinson, director of the G.E.C. in charge of the telephone, radio and television works.

Mr. P. Cattermull, F.C.I.S., general manager of the Tudor Accumulator Co., Ltd., retired on 30th September. He has had an active business life of fifty-two years, thirty of which have been spent with the Tudor Co., which he joined as secretary in July, 1919. He was appointed a director of the company and general manager in 1936, and in October, 1943, he became chairman. Mr. Cattermull will, at the invitation of the board, continue his connection with the company as chairman.



Mr. P. Cattermull (left) with Mr. A. Crompton, who has been with the Tudor Co. for fifty years

Obituary

Mr. David L. McFerran, electrical contractor, Belfast, died recently at the age of thirty-seven. He was the chairman last year of the E.C.A. Belfast Branch.

Mr. William Hackett, sales superintendent of the North Western Electricity Board No. 4 Sub-Area, died at Preston a few days ago at the age of forty-eight years. He was mainly concerned with work in the rural areas. Mr. Hackett joined the Preston Corporation electricity undertaking before the 1914-18 war.

Capt. A. W. Brown.—The death occurred on 11th October, at Bradford, at the age of seventy-three, of Capt. Arthur Walter Brown, M.B.E., J.P., a member of the Yorkshire Electricity Board. Capt. Brown was for the past twenty years Area Officer for the British Electrical Development Association, and he was a former Lord Mayor of Bradford. He leaves a widow, four sons and a daughter.

The late Capt. A. W. Brown

Mr. W. G. Coates.—The death occurred on 10th October at the age of sixty of Mr. William G. Coates, executive officer for the North Western Electricity Board, No. 3 Sub-Area (Rochdale) District, No. 3B, and former borough electrical engineer of Rochdale. Mr. Coates served his articles with the Nelson borough electrical engineer and before going to Rochdale, was with the Rawtenstall, Lancaster, Manchester and Radcliffe electricity undertakings. He joined the Rochdale electricity undertaking in 1920, and after holding various posts succeeded Mr. F. H. Rudd as borough electrical engineer in 1942, a position he held until his appointment to the North Western Electricity Board.

Mr. W. McGeoch.—In the notice relating to the late Mr. William McGeoch in our issue of 7th October, we stated that he had been in semi-retirement for the past twelve years. This should have read for the past twelve months.

Wills

Mr. H. Towers, managing director of A. Reyrolle & Co., Ltd., a director of Morphy-Richards, Ltd., and other concerns, and at one time associated with Edmundsons Electricity Cpn., Ltd., who died on 17th May last, left £32,048 gross (£30,548 net).

Mr. J. D. Taggart, B.Sc., A.M.I.E.E., who died on 9th June last, left £2,710 gross (£2,669 net).

Mr. T. A. Sedgwick, formerly chief electrical engineer of Vickers-Armstrongs, Ltd., who died on 20th July last, left £13,646 gross (£13,553 net).

Mr. C. Jones, M.Inst.C.E., M.I.E.E., who died on 2nd August last, left £8,955 gross (£8,880 net).

Mr. E. J. Kipps, M.I.E.E., of Birmingham, who died on 21st February last, left £6,252 gross (£6,227 net).

Lt.-Col. W. Bevan, M.B.E., M.I.E.E., acting manager in New Zealand of A. Reyrolle and Co., Ltd., left £25,648 gross (£24,835 net).

Mr. Ll. H. Harris, late principal of J. R. Colston & Co., electrical engineers, Oxford, who died on 3rd May last, left £7,728 gross (£7,685 net).

New I.E.E. Sub-Centre

THE first meeting of the North Lancashire Sub-Centre, affiliated to the North Western Centre of the Institution of Electrical Engineers, took place on 12th October, about 100 members being present. Dr. C. Dannatt, who presided, expressed his gratification at the culmination of the efforts made by so many people to form the new Sub-Centre. He then introduced the president, Professor E. B. Moullin, who took over the chair and formally inducted Mr. G. A. Robertson (manager, No. 4 Sub-Area, North Western Electricity Board) as the chairman of the Sub-Centre, who then delivered his inaugural address on "Electricity Supply in Rural Areas," comparing the advantages and disadvantages of various economic and technical influences. The address was illustrated by lantern slides showing graphical and tabular comparisons.

Mr. G. A. Robertson, chairman of the North Lancashire Sub-Centre

The secretary of the Institution, Mr. W. K. Brasher, proposed a vote of thanks to Mr. Robertson and added his good wishes for the success of the new venture.

The other members of the Sub-Centre Committee are: — Messrs. G. Pember (vice-chairman), G. K. Alston, H. Charnley, R. H. Harral, A. Hegan, H. W. Roberts and J. E. Shepherd; Mr. H. Carpenter is hon. secretary.

Views on the News

By REFLECTOR

FISHING stories are notoriously of the *cum grano salis* variety, but there may be something in one from Norway. It is said that patents have been applied for in respect of an electrical method of catching fish. According to the *Scotsman*, it is "based upon the fact that when two electrodes are placed in water and subjected to a certain tension and strength of current, fish within a certain distance move towards one of the electrodes. If the tension is great enough fish are paralyzed and die." This is all very well but the fish still have to be collected I suppose and so the method, although electrical, does not seem to be very superior to the trawl.

★ ★ ★

Reference was made in a recent leading article in the *Electrical Review* to managerial executives—a tautological term which defies exact definition. An attempt at interpretation has been made, however, in a recent pronouncement by Wage-Hour Administrator William R. McComb, reported in the *Electrical World*. According to Mr. McComb an executive must perform managerial functions while an administrative employee must perform work of substantial importance in the management of a business. This leaves me still seeking for an answer.

★ ★ ★

Guildford Corporation has told local members of the National Farmers' Union that it does not agree that some of the stands in Guildford market serve no useful purpose and says there is no space for a stand for the South Eastern Electricity Board. The farmers objected to the presence of stalls selling "grapes, crockery, toys and similar items" and they thought that room should be made for a stand at which they could discuss their problems with Electricity Board representatives. This is another indication of farmers' keen interest in and desire for electricity and I am glad to see it. At the same time I believe that the South Eastern Board has a service centre at Guildford where farmers and Board representatives might meet.

★ ★ ★

Commenting on an "invasion" of mussels into the Brighton power station through the water inlets, the Manchester *Daily Despatch* suggests that the British Electricity Authority may soon have to increase its payroll to include mussel catchers. I should have thought that the mussels themselves, which are said to have amounted to 230 tons in a recent clearance, would have been adequate recompense to the catchers. But perhaps it is the intention of the B.E.A. to go into the lucrative shellfish business.

★ ★ ★

An Oldham paper writes appreciatively of the amount of information about tariffs which now appears on the back of electricity accounts, but concludes by saying: "Impressive as they look, however, the new accounts still carry the same unwelcome message." That means, of course, that they are still bills. Well, services still have to be paid for and there are few things nowadays so much worth the money as electricity.

★ ★ ★

I do not know whether it implies anything defamatory to the habits of the occupants but, travelling by road between Manchester and Stockport a few days ago, I noticed no fewer than three houses with unusual electrical installations. One was a fluorescent tube used as a porch light—and very effective it was too—and the others were illuminated keyholes. The latter I have come across only once before (other than in exhibitions), and I was assured that they have definite advantages once the door and the key are found.

★ ★ ★

I have often heard of coal in the bath but the Countess of Rosebery has heard of something better. She told the Edinburgh branch of the E.A.W. recently that her husband had found refrigerators on a local authority's housing estate used for accommodating rabbits—live ones presumably. Lady Rosebery used this example to show the need for electrical education, but people who do this sort of thing must be impervious to any sort of education—electrical or otherwise.

Change of Frequency and Voltage

2.—Operation of Transformers and Induction Motors*

By
J. L. WATTS,
A.M.I.E.E.

WHEN the output circuit of a transformer is closed current flow in its secondary winding has a magnetic effect. The action between the primary and secondary windings occurs only through the magnetic field which links the two windings together, the effect thus being proportional to the number of ampere-turns. The primary and secondary full load ampere-turns of a transformer are practically equal, the respective voltages being nearly proportional to the numbers of turns, while the currents are almost inversely proportional to the turns. Thus all transformers can be treated as having a ratio of 1 to 1, so far as the internal actions are concerned.

The secondary side vectors (Fig. 1) are equivalent values which would occur with a 1 to 1 ratio. The primary current causes the flux Φ linked with both the primary and secondary windings, which is responsible for the induced primary voltage E_1 and the induced secondary voltage E'_2, these values being equal with a 1 to 1 ratio and no magnetic leakage. The secondary current I'_2 creates a magnetic field, some of which is not linked with the primary conductors, but merely leaks round the secondary turns. This leakage field causes the reactance volt drop $I'_2x'_2$ which leads the secondary current by 90 deg and the resistive volt drop $I'_2r'_2$ which is in phase with the current. The angle of lag of the secondary current behind the secondary terminal voltage V_2 is due to the power factor (cos θ_2) of the load circuit.

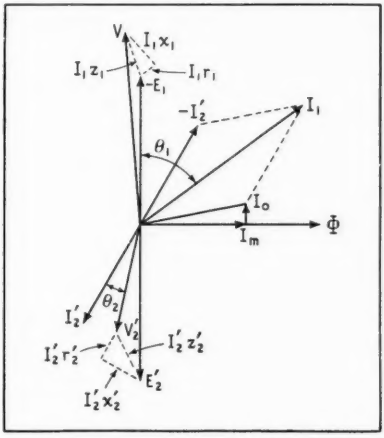


Fig. 1.—Vector diagram for loaded single-phase transformer treated as having a 1 to 1 ratio

The majority of the secondary ampere-turns, however, act in opposition to the primary ampere-turns. They cause the primary winding to have a reduced reactance volt drop, as a result of which the primary winding draws the component current $-I'_2$ from the input side to restore the flux almost to the original value. Thus the primary current now has the value I_1 and the volt drop in the primary winding is I_1z_1.

The fundamental equation of the transformer

$$E = 4 \times k \times f \times S \times \Phi_M \times 10^{-8} \text{ volts}$$

shows that Φ_M is proportional to $\frac{E}{f}$, provided magnetic saturation of the core does not occur. In this formula E is the induced voltage in a coil of S turns linked with a flux of peak value Φ_M of frequency f (in c/s) and form factor k. With a flux of sinusoidal wave form k is 1.11.

Voltage regulation is the change of secondary terminal voltage between no load and full load, due to the resistance and the leakage reactance of the two windings; it is usually expressed as a percentage for full load at a given power factor. Reduction of voltage applied to the primary winding of a transformer has the following effects: (1) Reduces the magnetic flux and magnetizing current. (2) Reduces the iron loss heating owing to the reduced flux-density

* Part 1 appeared in the *Electrical Review* of 14th October, 1949.

(B) as seen from Fig. 2. (3) Slightly reduces the transformer impedance. (4) Slightly improves the voltage regulation. (5) The full load current is practically unaltered, the full load kVA being practically

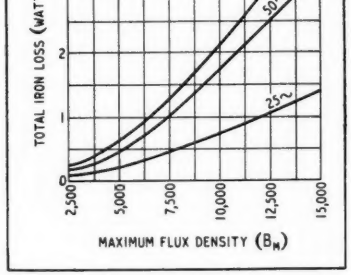


Fig. 2.—Iron losses in sample of transformer core steel 0.5 mm thick at various frequencies

proportional to the voltage. (6) Full load temperature reduced slightly owing to reduced iron losses and magnetizing current.

Increase of applied voltage has the opposite effects. The possible increase of voltage is limited due to core saturation, which may increase the magnetizing current very considerably and result in excessive heating.

A transformer can often be used quite satisfactorily at more than its rated frequency, with the following effects:

(1) Reduced magnetizing flux Φ and magnetizing current I_M, since Φ is approximately proportional to $\frac{V}{f}$.

(2) Reduced iron losses; eddy current loss, proportional to $f^2 B_M^2$, will be practically proportional to $\frac{f^2 \times V^2}{f^2}$ and so independent of the frequency; hysteresis loss, proportional to $f \times B_M^{1.6}$, will be practically proportional to $\frac{f \times V^{1.6}}{f^{1.6}}$ and so to $\frac{V^{1.6}}{f^{0.6}}$.

(3) Eddy current heating of the conductors of the windings will be increased, but this extra loss is likely to be small compared with the I^2R losses in the windings.

(4) The impedance volt drop of the windings will be increased, since:

$V_L = 2 \times 3.142 \times f \times L \times I.$

The reactance X_L and reactance volt drop V_L will be proportional to the frequency if the leakage flux per amp is unchanged.

(5) Due to the increased reactance, the regulation will be increased.

(6) Change of impedance may affect parallel operation of transformers; to be satisfactory the impedance should be within 10 per cent.

(7) Full load current and transformer ratio will be practically unchanged; full load kVA practically unchanged.

(8) Temperature at a given load reduced, increased eddy current losses in conductors being more than compensated for by reduced iron losses.

Table 1 compares figures obtained when two ranges of transformers of 25 and 50 c/s rating were used at 60 c/s. Eddy current losses in the copper are included in the total copper loss and are greater in the larger transformer due to the larger cross sectional area of its conductors. When used at increased frequency a trans-

TABLE I.—Operation of typical transformers at rated voltage at different frequencies

Rated Frequency c/s		25	50
Supply Frequency c/s		60	60
Iron Loss (% normal)		50–60	80–90
Magnetizing current (% of normal)		10–20	40–60
Total Copper Loss (% normal)	1.5 to 25 kVA Transformer	106	101
	37.5 to 200 kVA Transformer	111	103
Impedance (% normal)	1.5 to 25 kVA Transformer	125	109
	37.5 to 200 kVA Transformer	185	115
Regulation (% normal)	1.5 to 25 kVA (Unity p.f.)	102	100.7
	37.5 to 200 kVA (Unity p.f.)	109	108
	1.5 to 25 kVA (p.f. 0.8)	130	107.5
	37.5 to 200 kVA (p.f. 0.8)	160	111

former does not employ its materials to their best advantage. With a given number of turns the flux could be reduced at higher frequency, thus a core of smaller section could have been used.

Change of Both Voltage and Frequency

It is seldom practicable to use a transformer at its rated voltage and at a frequency appreciably lower than that for which it was intended, owing to the increase of magnetic flux density and magnetizing current, which may cause prohibitive heating if the saturation point is reached. Although in some liberally designed transformers a reduction of 10 to 15 per cent frequency may be permissible, the makers' advice should be obtained in all cases. It may be possible to use a transformer at reduced frequency if the voltage is reduced in a somewhat similar proportion so that $\frac{V}{f}$ and Φ are practically unaltered. In this case the iron losses will depend on the frequency, as may be seen from Fig. 2. The effect of simultaneous changes of voltage and frequency can be estimated by first considering the effect on the magnetic flux Φ, on the estimate that Φ is practically proportional to $\frac{V}{f}$.

There is considerable similarity between the action of a transformer and that of an induction motor. When at rest with its stator (primary) windings energized and rotor (secondary) open circuited, as may be the case of a slip ring induction motor, the motor acts exactly like a transformer of high magnetic reluctance, hence large magnetizing current, owing to large leakage flux due to the stator and rotor windings being separated by the air gap.

When the rotor circuit is closed with the stator energized, the changing magnetic flux produced by the stator current induces current in the rotor conductors. The reaction between the current-carrying rotor conductors and the revolving magnetic flux Φ of the stator creates a torque T which is equal to :

$$T = k_1 \times I_r \times \cos \theta_r \times \Phi,$$

where k_1 is a constant for the motor, I is the rotor current and $\cos \theta_r$ is the power factor of the rotor circuit. As the rotor accelerates from rest in the direction of the revolving stator field the latter cuts the rotor conductors at reduced rate, thus the value of the rotor e.m.f. and the rotor frequency fall. The rotor impedance also falls and the rotor power factor increases up to a speed at which the rotor reactance and resistance are equal. At this speed the motor has maximum torque. Fig. 3 also shows the effect of various ratios of R_r to X_2 where

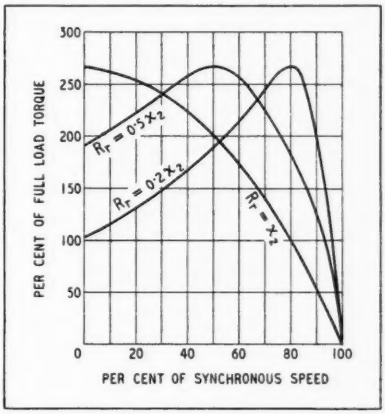


Fig. 3.—Curves showing the torque-speed relationship of a three-phase induction motor

R_r is the rotor circuit resistance and X_2 the reactance of the rotor circuit at standstill.

Change of Supply Voltage

The effects of applying to the motor a reduced voltage at normal frequency will (1) cause the magnetizing current and flux to be reduced almost in direct proportion ; thus the iron losses will be reduced and (2) the induced rotor voltage and current at standstill will be reduced in proportion to Φ ; thus the initial starting torque, which is proportional to $I_r\Phi$, will be reduced practically in proportion to V^2 where V is the voltage applied to the stator windings. The initial starting current will be reduced in a somewhat similar way (Fig. 4) which feature is employed to reduce the starting current of squirrel cage motors by means of star-delta, auto-transformer and series-parallel starters. The peak torque speed depends on the ratio of rotor resistance to rotor

reactance and is unchanged by change of stator voltage. At this speed the stator flux is still proportional to the stator voltage and so is the rotor current ; thus the peak torque is practically proportional to V^2.

The safe full-load torque is determined by the heating of the conductors. It may be considered as that torque which causes not more than the designed I^2R heating of the rotor conductors, meaning that torque which is exerted at normal rotor current. In order to retain normal full load rotor current at reduced stator voltage and stator flux, the "slip" must be increased slightly ; therefore the full load speed will be very slightly less than normal at reduced voltage. The safe full load torque, which depends on $\Phi \times I_r \times \cos \theta_r$, will thus be practically proportional to the stator flux Φ and so to the stator voltage V. The full-load horse power, proportional to the product of torque and speed, will be practically proportional to the torque and so to V.

Effect on Power Factor

Because of reduced flux and magnetizing current at reduced voltage the power factor is likely to be increased somewhat. In fact when a motor is required to run for long periods at less than about 35 per cent torque it may be an advantage to run it with its delta windings connected in delta in order to improve the power factor (Fig. 5) and efficiency. If a motor is run at increased voltage, the opposite effects occur. Apart from greater risk of insulation failure and increased starting current and torque, the larger flux may reach saturation point and cause prohibitive heating due to excessive magnetizing current.

Effect of Changed Frequency

When a motor is used at a higher frequency and normal voltage the stator flux Φ will be reduced, since it is practically proportional to $\frac{V}{f}$. The iron losses will be reduced due to reduced hysteresis and the magnetizing current will be reduced. The speed of the revolving magnetic field produced by the current in the stator windings will be directly proportional to the frequency. The e.m.f. induced in the rotor at standstill will be practically unchanged, since this will be proportional to $f\Phi$; however the increased rotor frequency at standstill will increase the rotor reactance and impedance at standstill, thus the rotor current and rotor power factor will be reduced.

The effects of increased frequency largely depend on the design of the motor, *i.e.*, on the ratio of the rotor resistance R_r to the standstill rotor reactance X_2. The standstill rotor reactance will be practically proportional to the frequency. On the one hand, if the rotor resistance is equal to the standstill rotor reactance, as may occur with a slip ring motor or a high resistance squirrel cage rotor, the starting torque may be reduced to about one-fifth of normal value when the frequency is doubled at normal voltage.

On the other hand, if the standstill rotor reactance X_2 is equal to $5R_r$,

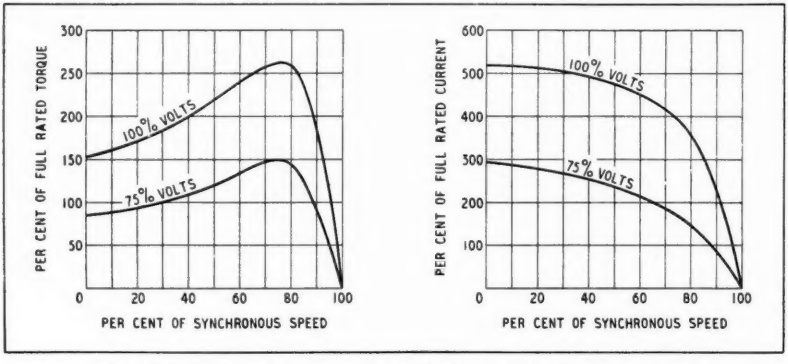


Fig. 4.—Illustrating the performance of an induction motor at reduced voltage

doubling the frequency may reduce the torque to about one-eighth of the normal value. Approximate results only can be mentioned as an indication of what may be expected. The peak torque of any motor may be changed approximately in proportion to $\frac{I}{f^2}$.

In order to retain normal full load rotor current at increased frequency the full-load fractional slip must be increased somewhat, the amount depending on the design of the rotor. The full-load speed will be practically proportional to the frequency. Full-load torque is proportional to the product of stator flux and rotor power factor. The full-load rotor power factor is little changed by change of frequency, but the flux Φ is practically inversely proportional to the frequency; thus full-load torque at higher frequency will be almost inversely proportional to the frequency. Horse power, which is proportional to the product of speed and torque, will be practically unchanged.

The effects of increased supply frequency, therefore may be summarized as follows, remembering, that the effects will depend somewhat on the design of the motor: (1) Speed increased practically proportional to the frequency. (2) Reduced magnetic flux and magnetizing current. (3) Usually some reduction of iron loss. (4) Reduced starting torque and peak torque; the reduced starting torque may limit the use of the motor at higher frequencies, especially if the rotor has a low resistance. A high-resistance starter may be advisable with a slip ring motor. (5) Full-load torque practically inversely proportional to frequency. (6) Full-load horse power practically unchanged. (7) Usually slight increase of power factor due to reduced magnetizing current.

Limit on Frequency Reduction

Reduction of supply frequency has opposite effects. The permissible reduction of frequency is limited owing to magnetic core saturation, which may cause the magnetizing current to increase to a prohibitively high value. Except so far as speed is concerned, an increase of frequency has somewhat similar effects to a reduction of voltage. It follows that if the voltage and frequency are both increased or decreased in the same ratio, so that $\frac{V}{f}$ is constant, the flux will be virtually unaltered. The full load torque will then be practically unchanged, the starting torque may be approximately inversely proportional to the frequency, with horse power and speed practically proportional to the frequency. For other combinations of voltage and frequency a rough guide to consequential effects may be obtained by considering that if the voltage is not changed by the same ratio as the frequency the starting torque and peak torque will depend on V^2, while the full-load torque will depend on the first power of the voltage, speed being proportional to the frequency.

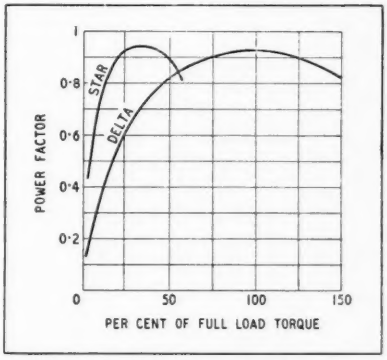


Fig. 5.—P.f. of three-phase induction motor

Maturing Tobacco

ELECTRIC heating apparatus designed by Mr. Eric R. Troward, founder and governing director of the British Pioneer Tobacco Growers' Association, The Hardings, North Cheriton, Templecombe, Somerset, has been working successfully in maturing both green and half-dried tobacco leaf. It is constructed out of two milk churns, with water in between them heated by an electrical element, thermostatically controlled to the desired temperature. The churns take about 20 lb of leaf at a time and use very little electricity. Several are being constructed to the design of the prototype. Mr. Troward tells us that electricity will probably be employed extensively next season in the Association's new curing plant at Crookham, Hampshire.

RECENT INTRODUCTIONS

Notes On New Electrical and Allied Products

Ring Lock Bush

TO protect cables from damage when passing through metal partitions, panels, etc., the INSULOID MANUFACTURING CO., LTD., Plastic Works, Mulberry Street, Hulme, Manchester, 15, has produced a ring lock bush consisting of a shaped plastic sleeve with an elastic locking ring. It can be assembled by unskilled labour without tools in a few seconds and no tapping or countersinking of the hole in the metal is required. Once fitted the bush cannot work loose and is extremely difficult to remove without the aid of tools. It is impervious to water, oil, petrol, acids and can be used safely in any temperature from −40 deg C to +100 deg C. A complete range of sizes is available.

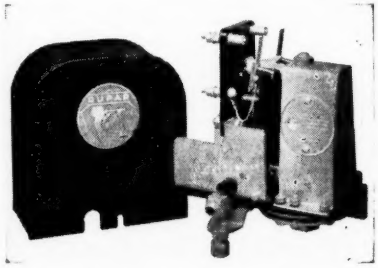
Automatic Immersion Heater

An automatic pattern of its domestic immersion heater has now been developed by CONTROLLED HEATING UNITS (LONDON), LTD., Avenue Road, Hampton, Middlesex. It is of the same general construction as the non-automatic heater, but by careful design the thermostat has been incorporated without appreciably increasing the overall height. The elements are of the standard "Rubicon" solid embedded pattern, and are not damaged by bending or dry heat. The thermostat is recessed in a heavy ceramic base, special attention having been given to terminal accessibility and size. The prices are as follows: 2 kW, 11in immersed length, £5; 3 kW, 12in, £5 5s; 3 kW, 16in, £5 10s; and 4 kW, 11in, £6 15s: all but the 4 kW model are subject to purchase tax. Due to improved manufacturing methods, prices of the non-automatic types have been reduced as follows: 2 kW, 11in, £3 7s 6d; 3 kW, 12in, £3 12s 6d.; 3 kW, 16in, £3 17s 6d, all plus purchase tax.

"Rubicon" automatic immersion water heater

Pressure Switch

As a further addition to the range of "Dupar" switchgear DEWHURST & PARTNER, LTD., Inverness Works, Hounslow, have introduced the "PR" pressure switch. This robust unit, which is arranged to provide double-pole quick-make-and-break switching, is provided with silver contact tips, rendering it suitable for direct switching of the smaller sizes of fractional h.p. motors, or for incorporation in the pilot circuit of contactor equipment of heavier installations. It is operated by the pressure on a fabric and rubber diaphragm and can be used with any fluid or gas which does not adversely affect the rubber diaphragm. Three types are available, namely, "PRA," "PRB" and "PRC," covering tripping pressures ranging from 20 to 250 lb per sq in. They can be supplied with or without unloader valve.

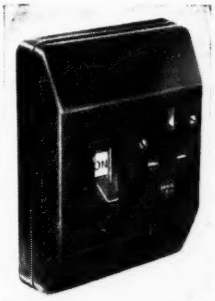


"Dupar" double-pole q.m.b. pressure switch

Fuse Wire Cards

A card holding various sizes of fuse wire is always a useful thing to have around the house, and WOODHURST EQUIPMENTS, Elec-

tra House, Kingsbury Green, London, N.W.9, have gone a step further by increasing its general utility. Apart from being wound with 5A, 10A and 15A tinned copper fuse wire this company's product has a screw key attached to it, which is similar in appearance to a motor car ignition key and is designed to fit fit all slotted head screws in fuse carriers.



"Sonnex" cooker control unit with 13A outlet

Cooker Control Unit

The first item of a new range of products from GEORGE H. SCHOLES & CO., LTD., Wythenshawe, Manchester, makers of "Wylex" electrical accessories, is the "Sonex" cooker control unit. It has been designed for those who want B.S. 1363 three-pin, 13A shuttered socket outlets and has a 60 A double-pole a.c. switch. The unit is made of brown or cream moulded material, is of pleasing appearance and measures $4\frac{3}{8}$in by $5\frac{1}{2}$in by $1\frac{1}{2}$in.

Soil Heating Cable

By the use of polythene as the dielectric the WARM-GLOW CO., LTD., 1133, London Road, Leigh-on-Sea, Essex, claims to have produced a low-priced soil-heating cable which can be safely used connected direct to the mains without the need for a costly step-down transformer. Polythene is tough, impervious to water, acids, alkalis, fertilizers, fungus growth, etc., and contains no plasticizer, so that it will not harden or perish with age. In an actual test 500 heavy blows with a standard 4-tine fork failed to damage the cable except for slight surface scratches and bruises, and electrical tests afterwards proved it to be still safe and serviceable.

The cable, which is loaded at 120 W, is supplied for two voltage ranges, 200-220 and 230-250. Each is about 45 to 50ft long, 0.14in in diameter, integral with a solid-mounted unbreakable 2-pin plug with nickel-plated pins. The tensile strength is over 50 lb and the cable can be bent double without damaging the insulation. The element itself is helically spun nickel-copper, non-corroding and almost unbreakable. The retail price is 30s, with a twelve months' guarantee.

Aircraft Turn and Slip Indicators

Gyroscopically controlled electrical turn and slip indicators, which have been approved for installation in jet-propelled aircraft, are in course of production at the works of R. B. PULLIN and Co., Great West Road, Brentford, Middlesex.

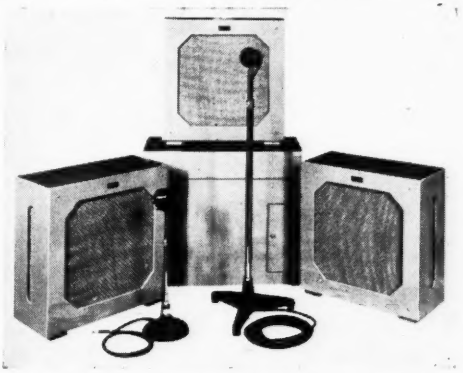
Flight at very high speeds demands a turn indicator of great accuracy, especially in the indication of slight divergence from straight flight, so the instrument is furnished with non-linear scales for both turn and slip indications to facilitate accurate reading near the zero mark.

Speed variation of the gyroscope is less than ± 5 per cent and the rotor, which is itself the armature of the driving motor, rotates round a fixed internal field. This saves weight and space, and the motor is self-screening since there is no external magnetic field to cause interference with the aircraft compass.

Whereas the pendulous inclinometer type of instrument has been chosen for R.A.F. use, a ball-in-tube type is also available and both are sufficiently sensitive for a 1 deg. deviation from correct bank to be clearly indicated.

Public Address Equipment

Transportable sound equipment for professional use will shortly become available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.


G.E.C. 20/30W transportable public address equipment

It is designed so that it can be quickly put into operation and may be carried on the back seat of a small car.

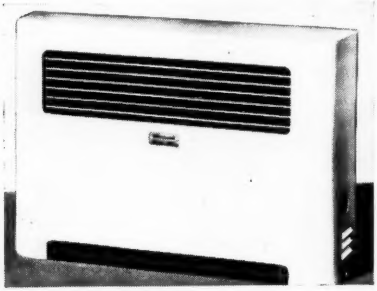
There will be two models, with total out-

puts of 20W and 30W respectively for operation on any 200/250V, 40/60 c/s mains or convertor supply. Class A high-fidelity amplification is used throughout and the performance of all valves can be instantly checked by means of a built-in "goodness meter" and rotary switch.

A useful feature is the incorporation of a groove selection device which is especially useful in connection with sound effects records. The entire equipment is built to a full tropical specification robustly constructed and finished in light grey enamel.

Convector Heater

It is announced that a new metal-cased "Thermovent" convector heater suitable for both floor and wall fixing or portable use has been added to the range of products made by E. K. COLE, LTD., Southend-on-Sea, Essex. This type "SA" heating appliance is finished in cream stove enamel and is available with or without thermostatic control.



"Thermovent" metal cased convector heater

Steam Sterilizer

An electric steam sterilizer has been specially designed by DUNCAN LOW, LTD., 299, Bell Street, Glasgow, for the treatment of ice-cream containers and other utensils. It is constructed of cast aluminium to withstand hard usage. Steam is generated at atmospheric pressure in a chamber under the tray on which the container is placed; it then passes through a jet and impinges on to the container. An aluminium cover over the container ensures that all parts are in contact with the steam. A wire basket is supplied for holding utensils and other small parts.

The water is heated by means of a 3 kW "Dunlow" immersion heater fitted with a safety switch (or contactor switch for d.c.) to operate if the water supply fails. The element being of the bolt-on type is easily removable. The safety valve is set to blow off at 3 lb/sq in pressure in the event of the jet becoming choked. A ball-valve automatically maintains the water at the required level. A small quantity of hot water for washing up, etc., can be drawn off through a cock fitted to the body. An additional thermostat can be provided and also a change-over switch to enable the unit to supply a greater quantity of hot water. A length of hose can be fitted to the jet for sterilizing outside the unit. Steam can be raised from cold in 30 min. The apparatus occupies a floor space roughly 2ft by 2ft and stands 3ft high.

"Dunlow" sterilizer for treating ice-cream containers, etc.

The price of the sterilizer is £32. An additional thermostat costs £3 and a 15 A change-over switch 18s.

Burglar Alarm

It is claimed that the "Tocsin" burglar alarm introduced by MADEWELL PRODUCTS, LTD., 4, North Parade, Sale, Cheshire, can be easily fitted and maintained by any electrician. A combination switch prevents the master unit door being opened at any time by an unauthorized person, bells ringing should the door be opened without first setting the combination. Additional combination switches can be installed to enable authorized persons to pass protected points. A selector switch allows varying degrees of control and any number of emergency buttons can be incorporated to operate even if the burglar alarm is not in use.

Open view of "Tocsin" master unit

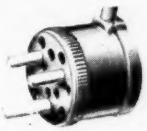
Normally the equipment operates from the

mains, but to safeguard against power failures or deliberate severing of the main supply, a relay is incorporated which automatically changes over the supply for the mains to emergency batteries and back again when the fault is cleared. The emergency batteries are capable of maintaining the system for several weeks if need be and can be checked by merely switching off the main supply and noting the difference in the intensity of the setting lights.

A complete unit, comprising one master unit with batteries and internal bell, one 6in outside alarm bell, eight micro-switches, one emergency button and one exit door combination switch, retails at 32 guineas.

Six-Way Plug

Although it is not much larger than the standard three-pin 15A plug, an accessory offered by CRATER PRODUCTS, LTD., The Lye, St. Johns, Woking, Surrey, contains six different sets of pins in its moulded body so that it will fit sockets ranging from two-pin 2A to three-pin 15A. The pins are threaded on their back ends and by manipulation of a six-position shutter, different combinations drop out as required. It is then only necessary to give each pin a twist until it is locked.



Six-way plug adaptable to different sockets

To ensure that these different combinations can be utilized to the fullest extent, the smaller two-pin types are arranged around the periphery of the plug, thus facilitating insertion into sockets which are near to the floor.

The BEAMA Catalogue

COMPREHENSIVE OVERSEAS BUYERS' GUIDE

WHAT should prove a potent factor in the promotion of export trade made its appearance on Wednesday last in the form of an authoritative and comprehensive catalogue of electrical machinery, equipment and appliances. This is the first edition of the "BEAMA Catalogue" published by Iliffe & Sons, Ltd., for the British Electrical & Allied Manufacturers' Association.

The Catalogue is the result of three years' intensive work by a special committee of the Association in close consultation with the publishers and it will be of the utmost value not only to overseas trade buyers, but also to the many official and semi-official bodies responsible for the promotion of export sales on behalf of British industry. In one volume they will have detailed information and illustrations of British electrical products ranging from heavy power plant to domestic appliances, together with comprehensive reference data for rapid identification of supply sources.

In a message introducing the Catalogue Mr. Harold Wilson, President of the Board of Trade, refers to the prominence of the British electrical industry in this country's export trade and says that the publication is an admirable example of the collective effort of an association to present to the world the great potentialities of the industry which it represents. It also symbolizes the realization of one of our leading industries of the value to prospective customers all over the world of a well-thought-out and comprehensive book of reference of its products and services.

The Catalogue contains 868 11½in by 8½in pages. It weighs 6½lb and is full bound in waterproof dark blue cloth with gold blocked lettering and plastic covered section dividers. Of the six sections, the first three, printed in three colours, in uniform editorial style, comprise a 740-page descriptive catalogue of the industry's products, grouped under three main headings:

Electrical power plant, covering the requirements of a modern electricity supply system from the power house to the sub-station. *Electrical equipment in industry, transport and communications*, covering industrial electrical equipment and lighting for mines, mills, factories, workshops, railways and transport undertakings. *Domestic and commercial electrical appliances, lighting accessories and installation material*, dealing with products for the application of electricity in the home or in the office.

The fourth section is a classified buyers' guide, listing all BEAMA members under 1,112 product headings; the fifth section is a directory of BEAMA members, with addresses, telephone numbers and cable addresses, branch offices, overseas representatives, etc. These two sections contain over 10,000 entries and the Catalogue has a comprehensive index.

Thirteen thousand copies of the Catalogue have been printed; of these 10,000 are being despatched overseas to principal buyers, distributors, municipal undertakings, Trade Commissioners, etc., in every country in the world, special mailing lists having been compiled by a BEAMA Committee.

Correspondence

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents

Zambesi and Kafue Investigations

REFERENCE is made in your issue of 2nd September, to the Zambesi and Kafue water power investigations under the title "South African News." May I point out that the Rhodesias form no part of South Africa and that this geographical term is commonly understood to refer to the Union of South Africa?

The Inter-Territorial Hydro-Electric Power Commission is a body set up by the Central African Council to investigate water power potentialities of the Zambesi and Kafue Rivers for the joint benefit of Northern and Southern Rhodesia. Its investigations are nearing completion and a panel of consulting engineers has been appointed to examine the information collected and report thereon to the Commission.

No decision has yet been made regarding an initial development of the very considerable water power resources possessed by the Rhodesias.

Salisbury, S. Rhodesia. A. E. T. BENSON, *Secretary,* INTER-TERRITORIAL HYDRO-ELECTRIC POWER COMMISSION.

Technical Education Problem

IN these days of increasing facilities for technical education may I state a case for the neglected "30s," who seem to be rather missed out of the general plan?

Nowadays the trend, almost universal in evening classes, is to place great emphasis and importance upon the National Certificate courses. I should imagine that 90 per cent or more, of all students attending evening classes at polytechnics and technical colleges are herded together, doing five years "hard," irrespective of their own personal reasons for wishing to acquire knowledge. These five-year periods of three evenings a week are probably ideal for lads of 16/18 leaving day school and just entering their first jobs; the compulsory attendance marks are no doubt needed to keep their noses to the grindstone.

There is, however, a large body of men to-day who, having been otherwise occupied during 1939-45, are endeavouring to obtain the necessary membership of the various engineering institutions. Apparently the organized courses are so worked out that these men have no alternative but to take the five years' grind for their H.N.C. and then on to three or four "endorsement" subjects before coming in sight of their goal.

Assuming, therefore, that these students (a) pass their examinations each year without fail; (b) obtain full attendance marks, irrespective of their wives and families and the 101 other things in the life of a 30-year-old student; (c) plough through first-year subjects, laboratory or "practical" work (no account being taken for the fact that they have had some 15 years' practical experience in engineering work of all kinds); (d) put aside all private life, most week-ends being taken up with piles of homework anyway, remain hale and hearty and allow nothing to stop them from turning up on examination nights; then they have a reasonable chance of becoming A.M.I.E.E. or A.M.Inst.C.E., etc. Should they be unfortunate enough to fail in any of the above conditions then another year (wasted) must be tacked on for repeating studies they have just been through.

I contend that such hidebound conditions are quite out of focus with the prevailing situation. This large body of "unlettered" men, not all ex-Service at that, are forced to waste valuable years plodding through the most elementary subjects in order to fulfil a set of academic rules laid down many years before the war.

So rigid is the outlook of present evening colleges that the very idea of anyone wishing to sit direct for "Joint Section A" causes an upheaval in the works. One college purports to coach for the direct entry but, on investigation, one finds two completely different subjects scheduled for the same evening!

I fail to see any reason for evening colleges ignoring the existence of a quite standard engineering examination which has been held twice a year for many years now. After all, the H.N.C. is of little use to anyone over 30 years of age. In many cases he already holds a position which calls for knowledge up to H.N.C. standard and which he probably fills quite efficiently. A concentrated course of up to four nights a week (starting at S3/A1 standards) for one winter session would probably enable the student to sit for section "A" in the spring. Furthermore, he would be able to sit again within six months should he fail in one or more subjects. This seems a simple matter to arrange and I should be glad to hear the views of education officials and also their reasons for the present mass-production system of technical education, which takes no account of individual circumstances whatsoever.

"AB INITIO."

Radio-Interference Suppression

E.R.A. TECHNICAL STUDIES

PROVISION has been made in the Wireless Telegraphy Act, 1949 (which received the Royal Assent last July), for the limitation of what is generally called radio interference, which is caused by other electrical equipment of many kinds.

Its sources and means of abatement have been studied by the British Electrical and Allied Industries Research Association for the past fifteen years, particularly methods of measurement which enable the degree of interference to be assessed, so that adequacy of reduction may be determined.

Measuring Equipment

Equipment devised by the E.R.A. for measuring the strength of interfering fields has been accepted as a reliable provisional standard for this purpose. Designs based on a measuring set developed by the Association for the Admiralty have been released for civilian use.

In parallel with these studies, factors in the design of machines which will influence the generation of interference have been closely examined with a view to its abatement. Satisfactory designs for suppressor components, which are economic, have been proposed and reported upon.

The radiation from medical and industrial high-frequency equipment has been studied and attention given to such power-operated domestic appliances as irons, refrigerators, vacuum cleaners, hair driers, thermostatic heating and cooking devices, discharge lamps, etc.; motor and control gear, trolley-buses, mercury arc and other rectifiers, lifts, railways, marine equipment, ignition and motor vehicle accessories.

Since the television service is the one most immediately affected by road vehicle interference, simplified measuring equipment, based on an E.R.A. design, working at a single frequency of 49 Mc/s, has recently been made available commercially (E.M.I., Ltd.) for the benefit of motor manufacturers and large-scale vehicle users who wish to reduce the interference from their vehicles to the prescribed level. Its measurements can be related to those of the E.R.A. equipment.

Vehicle Ignition Systems

Motor vehicle interference with radio equipment situated outside the vehicle comes almost entirely from the engine ignition system. Where the maximum degree of suppression is required, as in the case of military vehicles and aircraft carrying very sensitive radio equipment, screening of the ignition system may be essential; but for complying with the standard likely to be embodied in initial regulations, if any, resistors inserted in the high-voltage leads are the simplest and cheapest method of suppression.

Tests made on a large number of vehicles have shown that the insertion of a single resistor of 5,000-10,000 ohms in the lead from the ignition coil to the distributor (with the coil mounted on the engine block) will be satisfactory in the great majority of cases. Additional sup-

pression, when required, can usually be achieved by the insertion of resistors of similar value at the sparking plugs. Only in rare cases will additional resistors at the distributor end of the sparking plug leads be necessary. Satisfactory and economical designs of resistors are commercially available.

Controlled tests have shown that in general resistors, even of values very much higher than those envisaged for suppression, have no effect on engine performance and petrol consumption of the average motor vehicle.

Liaison between the Ministry of Supply (FVDE), the motor manufacturers, the Motor Industry Research Association, the ignition component manufacturers, the Post Office and other Government Departments responsible for military and civilian vehicles is maintained through an E.R.A. committee.

Some of the Association's work has been incorporated in the following six British Standards and two Codes of Practice:—

B.S.613—1940: Components for Radio Interference Suppression Devices (Excluding Devices for Traction, Marine and other Special Equipment).

B.S.727—1937: Apparatus for the Measurement of Radio Interference, Characteristics and Performance (under revision).

B.S.800—1939: Limits of Radio Interference (under revision).

B.S.827—1939: Radio Interference Suppression for Trolley-buses and Tramways.

B.S.833—1939: Radio Interference Suppression for Automobiles and Stationary Internal Combustion Engines (Limits and Methods of Suppression).

B.S.905—1940: Anti-Interference Characteristics and Performance of Radio Receiving Equipment for Aerial and Visual Reproduction (Excluding Receivers for Motor Vehicles and Marine Equipment).

C.P.1001—1947: Reduction of Radio Interference caused by Motor Vehicles and Internal Combustion Engines.

C.P.1002—1947: Abatement of Radio Interference from Electro-Medical and Industrial Radio-Frequency Equipment.

B.S.1597—1949: Suppression of Radio Interference in Marine Installations.

Infra-Red Baking of Stators

Sizes up to 100 h.p. Handled

BELIEVED to be one of the first concerns in the country to employ radiant heating for drying and baking of 100 h.p. wound stators, Tilling-Stevens, Ltd., of Maidstone, have recently laid down a plant capable of handling these on a continuous processs system. The stators are conveyed through a gas-fired infra-red tunnel on specially constructed trucks running on a track which is in the form of a continuous circuit. The trucks automatically engage and disengage from a hauling chain at predetermined points on the track, so located that each truck completes its heating and cooling cycle automatically.

The cycle of operation for 100 h.p. stators is briefly as follows: A day's output of stators is loaded on to the trucks and passes through the tunnel for drying out of the white windings. As each emerges, it travels a predetermined distance from the tunnel until its temperature has fallen to the required "dipping" condition. At this point it is automatically disengaged from the haulage chain, simultaneously lighting a signal lamp for the operator to transfer the stator to the impregnating tank. After immersion in the impregnating varnish and final draining, the stator is again replaced in another position of the track, so calculated that its re-entry into the tunnel for the final baking coincides with the last of the drying batch leaving the tunnel. For the baking process the speed of the haulage chain is reduced to give the required longer period of heating.

Stators of motors of 10 h.p. and under are loaded on to the trucks in batches, and are automatically dipped and drained on a continuous process impregnating plant.

The low speed of the haulage chain of 2.5 ft an hour from a motor drive of 1,400 r.p.m. called for a gear ratio of 163,000 to 1 for the baking speed and 90,000 to 1 for drying speed. To obtain these ratios a differential epicyclic speed reduction unit was designed, employing twelve spur wheels. The two speeds are obtained by two constantly engaged motors, one driving the train at the lower speed and the other idling on fast speed, and *vice versa*, a three-pole change-over switch selecting the motor required.

The gases given off during the baking period are collected from each end of the infra-red tunnel by suitably proportioned hoods connected to a 30in extraction fan via trunking. With the exception of the infra-red tunnels made by Parkinson and Cowan (Gas Meters), Ltd., the whole of the equipment was designed and manufactured by Tilling-Stevens.

Commerce and Industry

Devaluation and Import Licences

Dispute at Tir John Station

AS a result of recent changes in certain rates of exchange, some import licences, expressed in terms of sterling value, will not be sufficient to cover the full quantity of goods to which they were originally intended to relate. Arrangements have now been made to enable importers to meet their foreign currency commitments in respect of commercial contracts entered into on a foreign currency basis for the import of goods under valid import licences issued before 5th October, 1949.

Queries relating to machinery imports should be addressed to the Import Licensing Department, 91, Victoria Street, S.W.1. For imports of other types of goods queries should be addressed to the Import Licensing Department, Romney House, Tufton Street, S.W.1.

Strike at Tir John

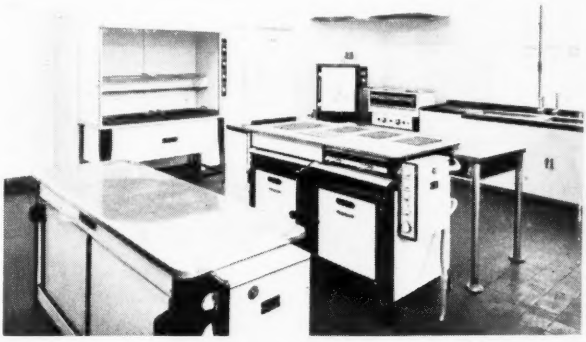
After an unofficial stoppage lasting four days 350 workers at Tir John power station, Swansea, decided last week to return to work on the understanding that the District Joint Industrial Council would meet as soon as possible to consider their claim that the British Electricity Authority had failed to implement a 1½d an hour increase in wage rates authorized in May by the National Joint Industrial Council. In a statement issued by the B.E.A. it was declared that the decision of the N.J.I.C. provided that all payments above the rates set out in the national agreement should be merged to the extent of the increase, except where the District Council recommended that the excess rates were justified by existing conditions. The men, most of whom belong to the Transport and General Workers' Union, contend that an agreement made originally with Swansea Corporation provides that wages paid to employees at Tir John shall be maintained at the rates fixed from time to time by the N.J.I.C., with an addition of 10 per cent.

French Import Relaxation

Among the goods which France now admits free of import licence are the following: Insulators (except steatite); electrical equipment for railways and other means of communication; other electric signalling equipment, not specified or included elsewhere; parts and components of electric signalling apparatus; and electricity meters.

B.E.A. Headquarters Kitchen

The new kitchen which has recently been installed at the headquarters of the British Electricity Authority is, of course, all-electric. The electric cooking apparatus, which is finished in cream and black vitreous enamel, has been supplied by the Jackson Electric Stove Co., Ltd., and comprises a two-pan fish fryer (16.2 kW), steaming oven (5.1 kW), 6ft hot-cupboard (5.6 kW), double oven cooker (26.75 kW), grill on stand (8.75 kW) and 10ft hot-cupboard (8.8 kW), a total loading of over 70 kW. Fluorescent lighting has been installed in both the kitchen and dining-room.



Jackson cooking equipment recently installed at the B.E.A. headquarters

Appliance Approval in America

Dealing with the subject of approval seals in the United States, the British

Counsellor (Commercial) at Washington in an article in the *Board of Trade Journal* makes particular reference to the seal of approval for electrical appliances of the Underwriters' Laboratories which, he says, is obligatory in at least half of the States and in most of the principal cities.

Before electrical goods receive the organization's seal of approval they are fully tested for defects and for safety, special attention being paid to connections, cords and switches. Before any new electrical product is placed on the market it is customary to submit several samples to the Underwriters' Laboratories for test. Attention is also drawn in the article to the need for seeing that products conform to the requirements of the American Standards Association.

Showroom Lighting Installation

The lighting of the showrooms of Blackwood, Morton & Sons, Ltd., Little Britain, London, carpet manufacturers and spinners, was planned by B.T.H. lighting engineers.

Mazda fluorescent lighting in Blackwood, Morton & Sons' carpet showrooms

"Mazda" fluorescent lighting fittings form the basis, a total of sixty-four such units being employed in the showrooms, ceiling mounted. They are grouped in pairs, one fitting on each side of specially designed boxes housing the control gear. The boxes are stylised to accommodate "Perspex" diffusing covers. "Mazda" 5ft 80 W fluorescent lamps provide the light source, in an overall combination of "warm-white" and "daylight" colours. This was found to give the best colour-pattern effect for viewing the carpets. The diffusing screens are made of opal 0.020 "Perspex"—deliberately heavier than usual for normal light diffusion in order to ensure as complete as possible a blending of the two lamp colours. An average light intensity of 12-14 lumens per sq ft is obtained. In the office and inquiry counter sections of the premises, the fittings have "Perspex" diffusing covers as standard, and again house 5ft 80 W fluorescent lamps. The illumination level here is of the order of 20 lumens per sq ft.

Packaging for the American Market

At a recent meeting of the Northern Branch of the Institute of Packaging, held in Manchester, Mr. C. A. Breskin, proprietor of *Modern Packaging*, New York, read a paper on recent developments in American packaging, in the course of which he showed the necessity of attractive packaging if British manufacturers were to extend their export trade to the United States.

Brush Turbine Order

The Brush Electrical Engineering Co., Ltd., has received an order from the Ministry of Works on behalf of the Ministry of Supply for one 15,000 h.p. 12,500 r.p.m. steam turbine for testing compressors in connection with gas turbine research.

Steel Erectors' Claim

Following the rejection of a claim by the Engineering & Allied Employers' National Federation for an extra 3d per hour, the Midland members of the Constructional Engineering Union have threatened a "go slow" movement. A meeting is to be held on 28th October, and according to a union official the "go slow" policy will probably be put into operation early in November. Among the buildings in course of erection which may be affected are the power stations at Nechells and Hams Hall, Birmingham, and that at Walsall. Several new gasworks will also be involved.

Industrial Supervisors

The first section of the Institute of Industrial Supervisors to be formed in the North Midlands was inaugurated at Newark on 13th October. The section will also serve members in Lincoln, Grantham and Mansfield. A meeting was held at the Town Hall, Newark, under the chairmanship of Dr. A. R. Bowen, Principal of the Newark

Technical College. A provisional committee was elected to plan the commencement of Institute activities.

"Brabazon" Hangar Lighting

Fluorescent lighting fittings made by the Strong Electric Corporation (Great Britain), Ltd., are extensively employed for the illumination of sections of the "Brabazon" hangar, including centre bay offices, electronics laboratory, instruments laboratory, photographic department, drawing offices and administrative offices. The type of unit selected for these purposes was the Strong "S101" 80 W industrial dispersive fitting. It incorporates a glazed toplight feature which provides a distributed upward light without detracting from the intensity of the illumination in the working region. The contractors responsible for the installation of the fittings were B. French & Co., Ltd., Kidderminster.

New Jackson Scottish Branch

A new branch office of the Jackson Electric Stove Co., Ltd., was opened at 104, West Campbell Street, Glasgow, on 5th October (telephone: Glasgow Central 3790). The opening was marked by a demonstration to an audience consisting of members of the South West Scotland Electricity Board. The branch is under the management of Mr. H. MacKenzie.

Trade Announcements

The **Sterling Cable Co., Ltd.,** announces that its new north western depot is now in operation in Manchester, where a complete range of Sterling rubber insulated cables and flexibles are held in stock. The agency for this area has been entrusted to E. J. Schofield & Co., Ltd., 17, Back Bridge Street, Manchester, 3 (Blackfriars 9016), to whom all inquiries for paper insulated cables should also be sent.

A new branch is being opened by **Simpson, Baker & Co., Ltd.,** on 31st October, at 8, Bolton Lane, Ipswich.

Atlas Lamp Sales Conference

Sales representatives of "Atlas" lamps (Thorn Electrical Industries, Ltd.), held a three days' sales conference at the Connaught Rooms, London, at the commencement of the lighting season, culminating with a dinner at which the chair was taken by Mr. A. S. Shier, sales director. The chief guest was the chairman and managing director Mr. Jules Thorn.

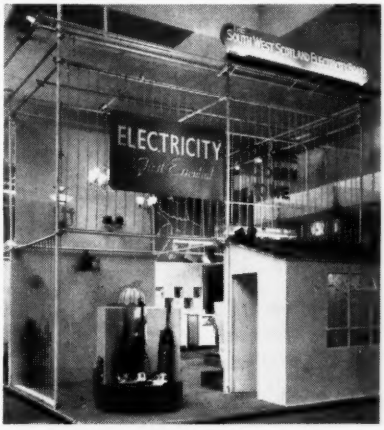
Speed-Nut Production

For some years now "Spire" speed nuts, sprung steel self-retaining fasteners which are available in a variety of forms as an aid to increased production efficiency, have been manufactured by Simmonds Aerocessories, Ltd., under licence from Tinnerman Products, Inc., Cleveland, Ohio, U.S.A. Recently, Mr. George A. Tinnerman, vice-president of the American company, paid a visit to the Simmonds works at Treforest, Glamorgan, and was much impressed with all he saw.

Mr. Tinnerman said that although his company had developed speed nuts in the first instance they could learn a great deal from their British associates on the production side. He also announced that it was his intention to place orders for some of the machines and equipment made at Treforest for use in his works in America.

Glasgow Modern Homes Exhibition

One of the attractions at the Modern Homes Exhibition now in progress at the Kelvin Hall, Glasgow, is the stand of the South West Scotland Electricity Board. The exterior of the stand has been cleverly



S.W. Scotland Electricity Board's stand at the Glasgow Modern Homes Exhibition

designed to give the impression of a modern house, but the visitor, on entering the "house," finds that apart from a completely furnished all-electric kitchen, the other rooms are, in fact, used simply to display a comprehensive range of domestic electrical apparatus. Access is restricted to the ground floor, but as there is no ceiling the "upstairs" section is clearly visible.

The "upstairs" walls are decorated with gaily coloured cartoon panels illustrating a bathroom scene, bedroom and nursery—the appropriate electrical apparatus being

superimposed on the cartoon. The theme of the stand is "Electricity . . . First Essential in the Modern Home."

Shop Lighting

"Technical Supplement No. 4," issued by the Lighting Service Bureau, 2, Savoy Hill, London, W.C.2, deals with shop lighting and describes methods to be employed for various types of goods. Copies of the Supplement can be obtained free of charge from the Bureau.

Catalogues and Lists

Sloan Electrical Co., Ltd., 41, Kingsway, London, W.C.2.—Two priced catalogues of domestic electrical appliances and "Reyrolle" industrial plugs, sockets and accessories.

Crypton Equipment, Ltd., Bridgwater, Somerset.—Leaflet announcing the price reduction of and availability of signs advertising the "Crypton" fast battery charger.

Siemens Electric Lamps & Supplies, Ltd., 38/9, Upper Thames Street, London, E.C.4. —Priced folder on "Full O' Power" radio and other dry batteries.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Six brochures dealing with various specialized aspects of heat treatment.

Next Week's Events

Monday, 24th October

BIRMINGHAM.—James Watt Memorial Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio Group. "Hot-Cathode Thyratrons: Practical Studies of Characteristics," by H. de B. Knight.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Utilization Group. Address by C. T. Melling, chairman of the Utilization Section, on "Electricity and Industrial Production."

LONDON.—Savoy Place, London, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Should Research in Electrical Engineering be pursued mainly in Research Departments in Industry or should it be transferred to Special Establishments?" To be opened by the President.

NEWCASTLE-ON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "The Phase/Neutral System of Supply for Rural h.v. Distribution," by G. T. Garwood and G. J. Websdale.

Tuesday, 25th October

LONDON.—At the Institution of Structural Engineers, 11, Upper Belgrave Street, S.W.1, 6.30 p.m. Institute of Welding. Presidential address by O. V. S. Bulleid. Tuesday, 25th, to Thursday, 27th October. Autumn meeting.

LOUGHBOROUGH. — Loughborough College, 6.30 p.m. I.E.E. East Midland Centre. "Polyphase Commutator Machines," by B. Adkins and W. J. Gibbs.

LUTON.—Chamber of Commerce, George Street West, 7.30 p.m. Luton Electrical Society. "Aspects of the Industrial Application of Electronics," by J. T. G. Milne.

MANCHESTER. — Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "The Detection by Oscillographic Methods of Winding Failures during Impulse Tests on Transformers," by E. C. Rippon and G. H. Hickling.

Wednesday, 26th October

LONDON.—Savoy Place, London, W.C.2, 5.30 p.m. I.E.E. Supply Section. Chairman's address, by J. W. Leach.

SCUNTHORPE.—I.E.E. Sheffield Sub-Centre, 7 p.m. "Waterworks Power Plant Practice: The Comparative Costs of Steam-, Diesel- and Electrically-Operated Machinery," by T. P. Wakeford.

Thursday, 27th October

BRIGHTON.—Royal Pavilion, 7.30 for 8 p.m. Electrical Industries Benevolent Association (Sussex Centre). Annual Ball.

LONDON.—I.E.E. London Students' Section, 6.45 p.m. Visit to Waterloo Signal Box.

LUTON.—George Hotel, George Street, 7.45 p.m. A.S.E.E. St. Albans Branch. "The Supervising Engineer in Industry."

Friday, 28th October

LONDON.—Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. Institution of Mechanical Engineers. Discussion on "The Lancashire Boiler," opened by T. F. Hurley and W. J. Sparkes.

39, Victoria Street, S.W.1, 6.30 p.m. Junior Institution of Engineers. "Nationalization of the Engineering Industry," by H. J. Novy.

Saturday, 29th October

LONDON.—Victoria Halls, W.C.1, 7 p.m. I.E.E. London Students' Section. Dance.

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Aspinall" electric alarm gong.

"Torville" electric toasters.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Board and Manufacturers

EXCHANGE OF VIEWS ON COMMON PROBLEMS

ON Thursday last week at Brighton the South-Eastern Electricity Board held another meeting with representatives of electrical manufacturers. This was the fourth of the series and about 160 people attended. Mr. W. R. T. Skinner, deputy chairman of the Board, presided, and he was supported by Alderman E. Simms (a member of the Board) and the chief officials, including Sub-Area managers.

Opening the proceedings, Mr. Skinner said that advance questions had been invited but only three had been received and one of them related to a purely "domestic" matter. The Board was asked whether it intended to proceed with the hiring of domestic apparatus, particularly immersion heaters. Mr. Skinner's reply was that in his opinion the removal of the 100 per cent purchase tax would do more to popularize the immersion heater than any hire scheme and he expressed regret that gas water heaters still received more favourable treatment in the matter of tax. He thought that the Board was unlikely to extend its existing hiring schemes and that these would probably be diminished or eliminated.

Contacts at Showrooms

The other advance question related to a supposed difficulty for manufacturers' representatives to make contact at the district showrooms with the men who "had the say" in purchasing. Mr. Skinner said that in general showroom managers could order appliances for the showrooms on their own responsibility.

Answering a further point by the same questioner, Mr. Skinner said that one Sub-Area had somewhat over-ordered a certain appliance and a temporary stop had had to be placed by headquarters on the purchase of the particular item. This was obviously a proper step, but he hoped that it would not have to be repeated.

At previous meetings he had referred to the proposed standardization of the smaller sizes of transformers used by the Board. A schedule of proposals had been placed before the appropriate manufacturers' association, but no comments had been received. On the assumption that silence signified assent, therefore, they had put their schedule into operation.

On 1st August the Board's hire-purchase terms for application throughout the Area had been announced; they were considered satisfactory if not "spectacular."

Central Purchasing

As regarded central purchasing the Board followed two principles. First, they would only purchase centrally where it was considered really advantageous. Secondly, they wanted manufacturers' co-operation through contacts with the districts. Before making purchases the Board obtained the views of district managers. He thanked manufacturers who had arranged visits to works, showrooms, etc., which served a useful purpose. In the six months April-September this year Area headquarters had placed only 5,850 orders out of over 45,000, i.e., about 13 per cent. In terms of value the proportion was about 20 per cent. He suggested that manufacturers might offer better terms for the purchase of large quantities.

Mr. Skinner said that he could not yet give a clear indication of the Board's future plans. At present every district manager was considering development in his district over the next fifteen years, stage by stage. Later these schemes would be co-ordinated by Sub-Area managers and presented to Area headquarters for consideration.

Mr. C. F. Wells, chief commercial officer, said that there had been considerable progress in the matter of appliance testing. The Burford establishment had been reorganized to deal with this on an Area basis and Mr. Hobbins was now devoting all his time to the work. The Board's centre for window dressing displays had been moved from Surbiton to Leatherhead, where it served the 86 showrooms in the Area. They would welcome the loan of display materials from manufacturers. A commercial panel had been

set up comprising representatives of each Sub-Area and headquarters to advise upon the acceptance of contracts for material for re-sale. Purchasing and stores assistants had been appointed in each Sub-Area.

Mr. Wells gave particulars of hire-purchase periods—three years for cookers, storage water heaters, refrigerators and kettles and two years for immersion heaters, vacuum cleaners, etc.—and said that later consideration would be given to the extension of these periods.

In the course of the general discussion which followed Mr. Neville (G.E.C.) said that he hoped that junior staffs would be encouraged to visit manufacturers' works and Mr. Skinner promised that they would be.

Mr. Perkins (Gresham Transformers, Ltd.) pointed out that not all transformer makers were members of the "appropriate association." He thought that standardization of tank fittings, bushings, ratios and tappings would be advantageous to manufacturers and he asked that details of the Board's proposals should be sent to the individual firms. Mr. Skinner agreed to see to this.

In reply to Mr. Neville, Mr. Skinner said that it was not easy to suggest the best method of ensuring that publicity matter and "literature" got into the right hands. He promised to see what could be done in the matter of classification of the wide variety of matter available.

Mr. Hart (Hoover, Ltd.) asked whether the Board's large buying power would not be used as a bargaining counter to set off one manufacturer against another. Mr. Skinner said that the consumer had the last word and the Board could not buy in large quantities things the consumer did not want.

Voltage Variations

Mr. Evans (Ekco-Ensign, Ltd.) drew attention to the harmful effects of voltage fluctuations and Mr. Skinner said that the Board had inherited severe voltage drops which it was hastening to remedy.

Mr. W. J. Jones (E.L.M.A.) suggested that standardization of voltage would be of greater advantage than any other standardization measure. The Board should endeavour to keep as close to the declared voltage, having regard to the effect of variations upon the life of appliances, as possible. In reply Mr. Skinner pointed out that against effects on the life of appliances had to be set the increased distribution costs involved. He felt that the Board had to take advantage of the tolerances allowed.

The meeting concluded with an expression of thanks by Alderman Simms to those who had attended.

Sixty Years of Trade Unionism

THE motto of the Electrical Trades Union, "Light and Liberty," is the title given to an interesting account just published of the sixty years' history of the Union, by Gordon Schaffer. The book is a frank portrayal of the fortunes of the E.T.U. through times of stress to its present strength as the eighth largest trade union in the country with a membership of 185,000 and assets aggregating £1,000,000.

The Union had a dual origin in Manchester and London, the immediate spur being the rejection by the Amalgamated Society of Engineers of applications for membership of that Society on the grounds that electrical workers did not possess the necessary qualifications. In 1890 the Manchester and London sections amalgamated, the total membership then being 570. By 1920 the membership had risen to 57,202, but in the period of depression which followed it fell to 26,165 in 1923, while its funds were reduced from £77,091 to £6,967. Mr. Walter Citrine (now Lord Citrine, chairman of the British Electricity Authority) who became assistant general secretary in 1920, was largely responsible for reorganizing the internal administration of the Union and his work formed the basis of a new financial structure finally adopted in 1924.

The ten years since 1939 have seen the greatest forward strides in the Union's history, the membership now being double the pre-war figure. On the resignation of the late Mr. J. Rowan from the general secretaryship Mr. E. W. Bussey succeeded to that position and when he was appointed a member of the B.E.A. Mr. W. C. Stevens (who writes a foreword to the book) was elected in his place. Mr. F. Foulkes succeeded to the position of general president in 1945.

In a concluding chapter "Facing the Future" reference is made to the Union's policy in relation to the nationalization of the electricity supply industry.

On Monday night a diamond jubilee celebration dance and cabaret was held at the Lyceum Theatre, London.

National Packaging Exhibition

New Methods Demonstrated at Manchester

FROM the electrical point of view the first National Packaging Exhibition held in collaboration with the Institute of Packaging at the City Hall, Manchester, was of twofold interest. Apart from the application of modern packing methods to electrical products, almost all the machinery shown for producing and applying the packaging materials was electrically operated.

The number of electrical appliances shown packed was not very great, but this does not imply that this class of product does not leave much to be desired in the matter of packaging. Apart from sales appeal (in the case of domestic appliances this is particularly important in relation to export) other points to be considered are the provision of adequate protection both against damage and pilfering, and facilities for handling and identification.

Risks to be Guarded Against

A series of photographs on the Institute of Packaging stand showed the various risks run by unsuitably packed products, while one of the most interesting sections of the Printing, Packaging and Allied Trades Research Association's display demonstrated actual tests undertaken to ascertain the strength of packages, their protective qualities against mechanical damage, water vapour and gas resistance, and resistance to attack from insects and moulds. Samples of packaging conforming to the recommendations of the Packaging Standards Committee were seen among the British Standards Institution exhibits.

Articles such as battery chargers, radio apparatus, etc., which are subject to corrosion but which cannot have preservatives applied to them were shown on the Board of Trade stand as packed for the Services, with a water vapour-proof barrier formed around them, a drying agent or desiccant being enclosed inside the plastic coating.

The use of simple yet strong wooden cases for the transport of electronic valves and batteries was demonstrated by Export Packing Service, Ltd., while models were used by Evan Cook's Packers, Ltd., to show their up-to-date methods of dealing with electrical, radio and X-ray equipment. Other types of wooden packing cases specially suitable for electrical products were represented by the National Federation of Box and Packing Case Manufacturers, Lloyd's Packing Warehouses, Ltd., and Jacksons (Edgefold), Ltd. For packing such articles as electric irons, batteries, etc., the Pontefract Box Co.'s new "Resil" units are moulded out of pulp and fibre to the exact shape of the appliance.

How corrugated fibre board can be utilized to pack fragile electrical devices was shown by the Corrugated Packing Materials (Sales), Ltd., and the Alliance Box Co., the latter company displaying a composite solid and corrugated bound case containing a cathode ray tube. The possibilities of wood wool for packing such articles as radio sets and electrical clocks were indicated by J. & W. Baldwin (Manchester), Ltd. Forms of "Telcothene" (specially processed polythene) and gutta percha suitable for packaging were presented by the Telegraph Construction & Maintenance Co., Ltd.

Heat Sealing methods

Among a range of Redifon industrial high frequency apparatus was a new equipment designed specially for welding transparent boxes made from cellulose acetate sheet. Boxes and lids up to 20in by 12in by 5in with overlapping edges can be dealt with, change over from one size to another being effected very quickly. Production of 300 completed medium-size boxes an hour is a comfortable maximum for any operator. Accompanying a "Hy-tra-lec" high-speed weighing machine on the Industrial Products (Speco) stand was a "Simmerstat" controlled heat sealing machine shown dealing with waxed paper bags containing potato crisps. A rotary type of machine heat sealing "Cellulose" wrappers on cigarette packets was in operation on the Avers & Grimshaw stand, and Charles E. Douglas & Co.,

Ltd., provided an opportunity for seeing in action their machines for sleeve wrapping and end folding in heat-sealing "Cellophane." Heat-sealing materials and methods of using them were also demonstrated by the Goodyear Tyre & Rubber Co. (Gt. Britain), Ltd ("Pliofilm"), and Imperial Chemical Industries, Ltd. ("Alkathene"). Applications of "Gloscoat" hot-dip plastic for the protection of metal parts, tools, etc., against corrosion were shown by J. M. Steel & Co., Ltd.

Apart from heat-sealing crimpers, the display of Ideal Packagings, Ltd., included packing, box-making, bag-making and wrapping machines. Automatic weighing and packing machines were seen in various types on the stand of the Automatic Weighing & Packing Machine Co., Ltd., George Driver & Son, and Southall & Smith Ltd., the last specializing in equipment dealing with free-flowing powder and granular materials.

Paper bag-making machines were shown on the stand of Cobden Chadwick, Ltd., and the Sheridan Machinery Co., Ltd., made a special feature of a corrugating and double-facing machine. Spiral strawboard tube winding machinery, semi-auto seamers, lid curlers, auto straight core winders, canister lidding machines were some of the electrically operated equipments shown working by Perkin & Co., Ltd.

Filling and Labelling Machines

Weight-operated electrically controlled machines were among various apparatus shown by Roberts' Patent Filling Machine Co., Ltd., for filling bottles, tins, drums and barrels. Fitting of bottle closures was carried out by equipment made by Metal Closures, Ltd., bottle cleaners being made by Nealis Harrison, Ltd. Automatic labelling machines were exhibited by Bratby & Hinchliffe, Ltd., and D. Trapow & Co., Ltd.

Battery operated vehicles have a particular application in food factories, etc., where the atmosphere must be kept free from fumes. Of particular interest in this connection was the "Conveyancer" fork lift truck demonstrated by Electro-Hydraulics, Ltd. Marton air hoists with capacities from 120 to 1,000 lb were to be seen on the stand of Smallpiece, Ltd.

NEW BOOKS

Guide to Broadcasting Stations. Compiled by *Wireless World*. Fifth edition. Pp. 88. Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 1s 6d (postage 1d).

Almost without exception Europe's four hundred long and medium wave broadcasting stations will be changing their wavelengths next March when the Copenhagen Frequency Allocation Plan comes into operation. In order that the new edition of this publication should not become out of date within a few months, it has been enlarged and includes, in addition to the present operating details of Europe's stations, those which will come into force on 15th March, 1950.

Operating details of nearly 1,300 short-wave stations of the world are given in tabular form both geographically and in order of frequency. In addition it includes information on European television and e.h.f. broadcasting stations, and special service stations.

Books Received

Basic Mathematics for Radio Students. By F. M. Colebrook, B.Sc. Second edition. Pp. 298; figs. 77; index. Published for *Wireless World* by Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 10s 6d.

Electronic Musical Instrument Manual. By Alan Douglas. Pp. 142; figs. 106; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 18s.

Modern Electric Clocks. By S. F. Philpott, M.I.E.E. Fourth edition. Pp. 228; Figs. 169; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 15s.

Radio Engineering. Volume II. By E. K. Sandeman, Ph.D., M.I.E.E. Pp. 579; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 40s.

The Electric Lamp Industry. By A. A. Bright, Jnr. Pp. 526; figs. 43; index. Macmillan & Co., Ltd., St. Martin's Street, London, W.C.2. Price 37s 6d in U.K.

Radio Frequency Heating Equipment. By L. L. Langton, A.M.I.E.E. Pp. 196; figs. 95; index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London W.C.2. Price 17s 6d.

Generation Practice

I.E.E. North-Western Centre Chairman's Review

As the jubilee of the establishment of the North-Western Centre (Manchester) of the Institution of Electrical Engineers occurs this session, Dr. C. Dannatt (chief electrical engineer, Metropolitan-Vickers Electrical Co., Ltd.) used the occasion of his inaugural address as chairman of the Centre to look backward and then forward with some certainty that the steam turbine would remain predominant for many years to come as the prime mover for electricity generation in land stations.

Use of Gas Turbines

In the interests of economy, peaks in the increasing demand for power must be reduced and the cost of providing peak-load capacity must be lowered. In the latter respect, it was "extremely likely" that the gas turbine would eventually be the solution. It lent itself readily to variation in design and thermal efficiency with corresponding adjustment of cost appropriate to particular conditions of load factor and fuel cost. They could look forward to the intensive development of the gas turbine for using solid fuel, either through the medium of the pressure combustion of pulverized coal, or by means of pressure gas producers. That would involve the provision of improved heat-resisting materials, better heat exchange equipment, study of fluid flow and the devising of new methods of dust precipitation. It would appear that the gas turbine, though not for some considerable time, would also form an integral part of nuclear energy plant as the link between the reactor and the electric generator.

It was certain, too, that much of the water power in the world would be harnessed, and it was essential that this country should retain a share of the business which a development of that kind would offer.

The Kaplan turbine had opened the way for the exploitation of low-head water power, especially where it was combined with irrigation or water transport schemes. The foreseeable size of such units was approaching 200,000 kW at speeds of the order of 100 r.p.m. The maximum size of high-head units was also likely to increase to possibly 100,000 kW at 600 r.p.m. Such developments, so far as the turbines were concerned, must be aided by experimental work on models. There was room in this country for further facilities for this type of work and also for increased collaboration between civil engineering firms and manufacturers of power plant. It was pleasing to note that the Mechanical Engineering Research Board, sponsored by the D.S.I.R., was including in its plant now being set up in Scotland a laboratory for hydraulic research.

There were indications that the limits of economic bulk power transmission by high-voltage a.c. were now being approached. Recent suggestions for the direct generation of high-voltage d.c. by electrostatic machines operating in compressed gas might have some application in this connection, but it was fair to say that at the moment the practical difficulties appeared almost insuperable.

Reduction in Weight

Thirty years ago, turbo-alternators scaled something like 12 lb/kVA, whereas modern machines were approaching 4·5 lb/kVA, with a likelihood of still further reduction. Similarly, electric motors had been reduced in weight during the same period by as much as 40 per cent. The main contributions to weight reduction had been the reduction of stray losses and more efficient means of ventilation. For instance, hydrogen cooling enabled the output from a given frame size to be increased by 15 per cent with hydrogen at $\frac{1}{2}$ lb/sq in, and increases of 30 per cent and 36 per cent were possible by using gas pressures of 15 and 25 lb/sq in respectively. The process of improving thermal dissipation in machines would continue and the extent to which machine temperatures could usefully be increased required further study, since efficiency was adversely affected by further increase in load if the losses dependent on load exceeded the no-load losses.

The mechanical problems associated

with large machines frequently imposed limitations in design. Forty years ago forgings had an ultimate stress of 34 tons/sq in and a yield stress of 17 tons/sq in; comparable figures for modern forging were 45 tons ultimate and 36 tons yield stress. but the uncertainty factor inherent in highly stressed cast or forged steel rotating parts could often be avoided by adopting fabrication from rolled plates and sections, which form of construction was likely to be used more extensively in the future for the rotors of large waterwheel generators.

The industry would become entirely unbalanced if the future held for it nothing more than technical advance. Designers must increasingly pay attention to the utilization of new materials and processes with the object of reducing production costs. This presupposed that the output of the factories could be so organized that standardization was applied to permit of mass, or at least repetitive, manufacture wherever it was possible.

It was frequently laid at the door of the manufacturer that his efforts at standardization fell short of what was desirable, but it was surely equally the duty of the users to agree on their requirements. Indeed, it appeared that standardization rightly began with the user. It might well be that one of the advantages accruing from our nationalized industries might be action along these lines. One thing must, however, be avoided, standardization must not be allowed to discourage further research and development.

Staff Questions

Effect of Educational Changes

SOME staff problems in industry were commented upon by Mr. D. C. Fleming (staff officer, British Insulated Callenders' Cables, Ltd.) in his address as chairman of the Mersey and North Wales Centre (Liverpool) of the Institution of Electrical Engineers.

Raising the school leaving age had reduced the flow of entrants to industry, so causing a serious shortage of juniors in factories and offices. Their value had thus been enhanced, their wages had risen more steeply than those of any other categories, which was unfortunate in several respects.

Socially, it was of doubtful benefit and the exaggerated financial discrepancy might discourage students from proceeding with a university career.

Employers had not experienced difficulty with part-time release of apprentices for technical studies, because their number was limited. The position would be very different when the County College scheme became effective, for it would require the release of all young employees within the defined age range. It might, indeed, have been simpler to arrange for the classes to cover the whole year, instead of 44 weeks, so enabling five young persons to be employed for every four effectives needed.

Industry, besides being inconvenienced by schemes of this sort, would have to pay for them in the long run, so would expect to be assured that it would obtain value for its money. Educational changes were imposing fresh obligations on industry, which must prepare itself for them. If the cleverer young people were to be skimmed off for continuing full-time education, less reliance would be placed on those left to enter into employment as juniors.

There was also a close connection between the higher school leaving age and that of national service. The reduction of the intervening period of employment increased the employers' liabilities for reinstatement and could be an embarrassment to smaller concerns.

The increasing number of engineering graduates coming from the universities would lead to the twin problems of providing them with practical training and of afterwards fitting them into industrial organizations without creating the impression that they were unduly favoured merely because of the education they had received, by comparison with entrants through the shops by way of trade apprenticeship.

A useful development was the interchange of apprentices between firms and also the movement at intervals of senior members of staff from one section to another within the same organization. The merits of a definite promotion policy, which should be made known to all concerned, would repay investigation.

The address concluded with references to methods of selecting candidates for employment, since the possession of a technical qualification would not by itself carry a man so far in the future as it had, on the average, done in the past.

Study of Measurement

Professor J. Greig's Address

ELECTRICAL measurements, as a subject of study in universities and technical colleges, had attracted less attention than radio and electronics, said Prof. J. Greig (King's College, University of London) in his inaugural address as chairman of the Measurements Section of the Institution of Electrical Engineers.

The fact that the subject not only touched every branch of electrical engineering, but was also applicable in many ways outside the purely electrical sphere, was an embarrassment in the framing of any general syllabus. The professor considered it would be unsound to fix an arbitrary upper limit of frequency for radio topics.

The M.K.S. System

Some aspects which in the light of his own teaching experience seemed to deserve greater emphasis were commented upon under six headings. First, from the teaching standpoint, there was great advantage in a single self-consistent system of units. The use of the M.K.S. system was proceeding a good deal more slowly than many of its advocates would wish. Although of very real benefit to electrical engineers, the system had relatively little to recommend it to civil and mechanical engineers, and it seemed questionable whether physicists as a whole favoured its universal introduction. Personally Prof. Greig favoured its introduction on a rationalized basis (and with the quantity Q as the fourth fundamental dimension) to electrical students so soon as they ceased to receive instruction in association with civil and mechanical students.

Secondly, apart from the large-scale development of instruments incorporating metal rectifiers, measuring devices had been improved in detail rather than in principle. The greatest impetus had been due to the invention of the negative feedback amplifier. Its effects, conceptional as well as directly practical, had been far-reaching.

The introduction of amplification to the measurement field had brought the "signal-to-noise ratio" phenomenon to the forefront. It illustrated in a most vivid way the fact that even the possession of the means of unlimited amplification did not necessarily imply the ability to detect, or measure, very small signals. The greatly increased significance of the concept of "noise" in relation to measurement added further weight to the importance of including the elements of probability theory (not merely that of observational errors) in engineering students' courses.

Thirdly, there had been distinct changes in emphasis on various methods of measurement which should be reflected in university courses. Several methods of measuring power which had for many years been regarded as of only academic interest were now assuming practical significance.

Fourthly, the measurement of some of the characteristics of dielectric and magnetic materials presented special problems. Fifthly, there was continuous measurement, of which servo-mechanism was a form, for automatic regulation and process control. The sixth category, the electrical measurement of non-electrical quantities, was the most difficult from the point of view of drafting a syllabus. This subject really constituted a distinct branch of technology and there was within it so much diversity that representative sampling was impracticable.

G.P.O. Staff Awards

DURING the quarter ended 30th June last, the Post Office awarded various sums totalling £488 to members of its staff in respect of 233 suggestions submitted by them for improving the services. The highest award for the quarter was £40 paid to a telephone mechanic in the Factories Department who suggested a new method of wiring switchboard night extension keys which led to a material reduction in the number of keys used. The second highest award of £30 goes to an assistant engineer in the Cardiff Telephone Area for suggesting a revised method of cabling for certain types of telephone exchanges.

FINANCIAL SECTION

Company News
Stock Exchange Activities

Reports and Dividends

Anglo-Portuguese Telephone Co., Ltd.—Presiding at the annual meeting held on 11th October, Sir Alexander Roger (chairman and managing director) said that during 1946, 1947 and 1948 telephone material of British manufacture to the value of approximately £1,000,000 had been shipped to their company in Portugal, and the company had purchased in Portugal itself further material costing over £330,000. To carry out their heavy expansion programmes a regular flow of new capital was necessary. For the past three years all new capital had been advanced on loan account by Telephone & General Trust, Ltd. The development and expansion of their company required that these temporary advances should be converted into a more permanent form of capital, and the directors intended to do this as soon as plans could be completed, following a settlement of negotiations in Portugal.

The number of stations added in 1948 was 7,913, making the total 88,459. During the past three years 23,254 stations had been brought into service and this expansion had been carried out clearly on the understanding that the company's tariff structure would be satisfactorily adjusted. The waiting list for telephones was 25,000. Negotiations were still proceeding with the Portuguese Government for an adjustment of the telephone rates.

Newton Brothers (Derby), Ltd., held their annual meeting on 10th October when Mr. P. C. Cooper-Parry (chairman) said that export trade amounted to 19 per cent of the total sales, with export orders in hand of 11 per cent, as compared with 12 per cent and 20 per cent respectively, for the previous year. The value of the automatic voltage regulator to the war effort was immense and it was gratifying that a settlement had been made which recognized this to both the inventor (Mr. Fred Newton) and the company. Since the war the demand had continued at a high level from all the technical services associated with defence, and the demand for industrial application was making steady progress.

At an extraordinary meeting which followed the annual general meeting a resolution was passed authorizing the capitalization of £78,992 8s of the reserves and the issue to shareholders of 789,924 ordinary shares of 2s each fully paid in the proportion of one share for each share held.

Cable & Wireless (Holding), Ltd.—The governor and directors announced in August last that they had every hope that by mid-October there would be in the hands of stockholders the balanced scheme of reconstruction to which the Governor referred at the annual meeting of the Holding Co This scheme is now ready. The necessary Court formalities are being proceeded with and the first formal steps have been taken for the purpose of convening the necessary meetings at which this scheme will be submitted. It is hoped that the scheme and requisite notices, proxies, etc., will be posted on 1st November and the meetings will be held on the 25th November to consider and, if thought fit approve, the scheme.

Solus Teoranta (the electric lamp making concern in which the Irish Government holds a substantial interest) reports a net profit for the year ended 30th June last of £23,393 as compared with £22,226 for the preceding year. After providing for depreciation, taxation, etc., it is proposed to pay a final dividend of 5 per cent, again making 10 per cent for the year. The balance carried forward is £4,341.

Lightalloys, Ltd., reports a profit for the past year of £50,271, as compared with £21,223 in the preceding year. Taxation requires £28,000, leaving a net balance of £22,271 (against £12,745). It is proposed to pay a final dividend of 10 per cent, making 15 per cent for the year (unchanged).

Holophane, Ltd., reports a net profit for the year ended 30th June last of £66,142, and after providing for taxation, etc., there is a balance of £29,743 (against £22,351). The final dividend is 7½ per cent, again making 15 per cent for the year, and £29,092 is carried forward (against £37,598 brought in).

The Britannia Electric Lamp Works, Ltd., proposes to pay a dividend for the year of 12½ per cent (unchanged).

Glenfield & Kennedy, Ltd., are again paying an interim dividend of 5 per cent.

The London Electric Wire Co. & Smiths, Ltd., has declared an unchanged interim dividend of 4 per cent.

Babcox & Wilcox, Ltd., have declared an interim dividend of 5 per cent. This is

at the same rate as for the preceding year, but is paid on ordinary capital increased by £16,609 new £1 shares.

Oldham & Son, Ltd.—At the recent extraordinary meeting resolutions were passed to distribute a scrip bonus of 100 per cent to shareholders.

The Calcutta Electric Supply Cpn., Ltd., is paying an unchanged interim dividend of 3 per cent, tax free.

The company is holding an extraordinary meeting on 9th November at which a resolution will be submitted adopting new articles of association.

New Companies

Stoneley Electrical Appliances, Ltd.—Registered 8th October. Capital £2,000 Manufacturers of and dealers in electric dishwashing and drying machines, electric control gear, etc. Directors: E. S. Hughes, W. V. McPhie and J. Malcolm. Regd. office: The Common, Buckley, Flintshire.

Nuvac Neon Signs, Ltd.—Registered 8th October. Capital £500. Manufacturers and installers of neon and fluorescent lighting equipment, etc. Directors: T. J. Sloan and M. Newman. Regd. office: 14, North John Street, Liverpool, 2.

Stead & Firth, Ltd.—Registered 6th October. Capital £3,000. Electrical engineers and general electrical installation contractors, etc. Directors: W. Firth and Mrs. Elizabeth W. Firth. Regd. office: 1-5, Royle Fold, Heckmondwike, Yorks.

Fred G. Alden (Refrigeration), Ltd.—Registered 14th September. Capital £10,000. To carry on at Oxford and elsewhere the business of refrigeration, heating, ventilating and electrical engineers, manufacturers of electrical apparatus and equipment, etc. Directors: F. G. Alden, G. W. Allmond and H. J. Huckings (all directors of Fred. G. Alden, Ltd.) and C. Mann. F. G. Alden is permanent governing director and chairman. Secy.: C. Mann. Regd. office: 6-7, New Road, Oxford.

Burdon Hygiene Services, Ltd.—Registered 13th September. Capital £5,000. Manufacturers and merchants of and dealers in electro-medical, radio, electronic, scientific, hygienic, surgical, optical and other instruments, appliances, etc. Permanent directors: L. J. Donovan (director of Electronic Products (Glos.), Ltd.) and J. J. Denny (director of Pilot Industrial Trust, Ltd.). Secy.: E. G. Scott. Regd. office: 7, Carteret Street, Queen Anne's Gate, S.W.1.

W. G. MacLaren, Ltd. Registered 20th September. Capital £100. Designers, patentees, manufacturers, exporters and importers of and dealers in all kinds of electrical apparatus and devices, etc. Directors: W. G. MacLaren and H. S. Homerstone. Regd. office: Westwood House, Alexandra Road, Hemel Hempstead, Herts.

Tony Reynolds, Ltd.—Registered 16th September. Capital £3,000. Electricians, radio and television engineers, contractors, etc. Directors: D. A. Reynolds and D. Dawson. Regd. office: 9, Lichfield Terrace, Sheen Road, Richmond, Surrey.

Loosmore Bros. (Bridgend), Ltd.—Registered 23rd September. Capital £500. Radio, electrical, mechanical engineers, etc. Directors: A. Loosmore and H. Loosmore. Secy.: H. Loosmore. Regd. office: 39, High Street, Haverfordwest, Pembrokeshire.

Birmet Television Manufacturing Co., Ltd.—Registered 6th October. Capital £2,000. Directors: E. W. Slaughter, G. E. Titley and A. F. Moulton. Regd. office: 69, Lavender Hill, S.W.11.

F. J. Coleman (Electrical Contractors), Ltd.—Registered 26th September. Capital £4,000. Permanent directors: Mrs. D. H. Coleman, F. J. Coleman and F. A. Tokley. Secy.: F. A. Tokley. Regd. office: 242, Kingston Road, New Malden, Surrey.

L. E. Gillam, Ltd.—Registered 28th September. Capital £1,000. Electrical, lighting, heating, refrigerating, wireless, mechanical and general engineers, etc. Directors: L. E. Gillam and J. W. Hopkins. Regd. office: 59, Park Lane, Oldbury, Worcs.

Increases of Capital

Dowding & Mills, Ltd.—Increased by £25,000 in 1s ordinary shares, beyond the registered capital of £25,000.

Creed & Co., Ltd.—Increased by £200,000 in £1 ordinary shares, beyond the registered capital of £150,000.

Liquidations

British Rola, Ltd.—Particulars of claims by 30th November to the joint liquidators, Messrs. K. R. Clark and G. C. Jarvis, c/o Mordant, Jarvis, Garvin & Co., Ling House, 10-13, Dominion Street, South Place, London, E.C.1.

In the Companies' Court on Monday last, 17th October, Mr. Justice Vaisey assented to the dismissal with the consent of all parties, of a petition for the compulsory winding-up of this company which is in process of voluntary liquidation.

Bankruptcies

F. Cresswell, carrying on business at Market Chambers, Mansfield, electrical engineer. —Last day for receiving proofs for dividend, 29th October. Trustee, Mr. A. J. Rogers, 22, Regent Street, Park Row, Nottingham, Official Receiver.

FINANCIAL SECTION
STOCKS and SHARES

STOCK Exchange markets took on an extremely subdued tone at the beginning of this week. Guesses were rife as to what steps the Government would take. The phrase "consequential measures following devaluation" did not suggest hopefulness in the direction of relaxation of restrictions or taxation, and, on this account, prices of home industrials were generally lowered, while British Government and other gilt-edged issues gave way in most cases.

One of the principal anxieties in the gilt-edged market has been the possibility of a rise in Bank rate, and of a spell of dearer money, as part of the plan to deflate the internal results of the currency devaluation. Such a policy would, it is thought, be more likely to develop after than before a change of Government, so that the General Election announcement brought momentary relief to the market. The rally was short-lived. Prices of British Electricity 3 per cent stocks slipped back to 93¼ for the 1974/77 issue, and 93⅞ for the 1968/73 stock. British Transport three per cents eased off to 90.

The Week's Changes

Rises and falls are almost equally balanced in the prices of electrical manufacturing shares, as well as in those of others connected with the electricity industry. Most of the changes are small. Declines of 1/6 made Johnson & Phillips £3, Thorn Electric 15s, and Tube Investments 5½. General Electrics went back 3s to 75s 6d, International Combustion to 19s, De la Rue to 22s 6d. Improvements have occurred in Murex, 45s 9d, Aberdare Cables 56s 3d. Ward & Goldstone at 48s 6d are 1s to the good. Smaller rises are shown by Hoover, 33s 3d, Burco, 19s 6d, and Babcock, 62s 9d. Cable & Wireless ordinary is 3 points lower at 237: the long-awaited plan of the board is to be published on 1st November. British Electric Traction deferred is 25 down at 1475. Vactrics at 10s have fallen by a florin. At 15s 6d E.M.I. are 9d lower on the week. Pye deferred remain firm at 29s 6d.

J. Lucas Scheme

Widespread interest is being taken in the profit-sharing scheme to be introduced by the Joseph Lucas company. It was passed by shareholders as long ago as 1933, as a scheme by which the "workpeople may benefit in some degree from any future prosperity the company may enjoy." The method is by issue of 100,000 redeemable £1 preference shares to the Lucas Workers' Share Bank. The shares are entitled, with the ordinary shares, to a 3 per cent dividend, after which the two classes rank equally for remaining profits. The ordinary shares, which have eased this week to 78s 9d rank among the blue-chips of the industrial market. Strength of the reserves has been associated for some time with bonus possibilities.

Matters of Moment

Anglo-Portuguese Telephone fell 1s 9d to 25s 9d on consideration of the chairman's speech at the recent meeting, when he hinted at the possibility of fresh money being required in order to cope with the expanding business of the concern. The Anglo-Portuguese Company has been one of the most consistent dividend payers in that market, an annual 8 per cent having been distributed for more than twenty years.

Oldham & Son's ordinary shares are now quoted ex the bonus. Old and new are 5s 6d middle. At the meeting last week, the chairman, Mr. John Oldham, declared that in the period ahead, "British industry probably faces the fight of its life." Automatic Telephone at 52s 6d are 1/6 better; the new shares are now 20s paid and stand at 3s 6d premium. The final call of 30s falls due, as mentioned here last week, on 25th November. Shares which seldom change in price are Whitehall Electric £1 ordinary, but during the past few business days these have moved up to 11s 3d.

East African Power

Following upon the announcement reported in last week's issue, East African Power & Lighting ordinary shares fell 7s to 33s 9d, in consequence of the company's intention to issue a million 4 per cent £1 preference shares at 20s and a million £1 ordinary shares at 30s. Subscription lists open and close to-day, 21st October. The issue is larger than had been expected. Possibly for this reason there was a little doubt as to how it would be received by the shareholders, although, so far as the ordinary shares are concerned, the new are offered well under the existing market price of the old shares. The latter have been receiving 7 per cent dividends, giving a yield, at their previous price of 40s 9d of £3 8s 8d per cent. The modesty of the yield is explained by the fact that dividends are paid free of tax to non-residents. At the issue price of 30s, the new shares, assuming maintenance of the 7 per cent dividend, would return £4 13s 4d per cent.

Electricity Supply

Generation in September : Cooling Tower Design

A TOTAL of 3,672 million kWh was generated by the British Electricity Authority, the North of Scotland Hydro-Electric Board and Lochaber Power Co. during September, an increase of 3.1 per cent compared with September, 1948. Installed capacity amounted to 13,564 MW, a net gain of 572 MW on the year. Further details of output, etc., are given in the accompanying table.

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	Steam	Water Power	Total*		
British Electricity Authority ...	2,175	3.6	3,570	8	3,590	3,376	13,239
North of Scotland	16	0.8	27	52	82	80	325
Total for September, 1949 ...	2,191	4.4	3,597	60	3,672	3,456	13,564
Corresponding total for September 1948	2,113	3.2	3,421	126	3,561	3,360	12,992
Increase or decrease as a percentage of 1948	+3.7	+37.5	+5.1	−52.4	+3.1	+2.9	+4.4
Total for year to date (nine months)	20,707	35.7	34,091	827	35,060	33,047	
Total for corresponding period of 1948	20,136	27.7	32,374	952	33,442	31,537	
Increase or decrease as a percentage of 1948	+2.8	+28.9	+5.3	−13.1	+4.8	+4.8	

* The total figure includes generation by oil engines, refuse destructors and waste heat plants amounting to 5.8 million kWh, 0.1 million kWh and 8.3 million kWh respectively in September, 1949.

Assisted Wiring and Hire-Purchase

At a meeting of the London Electricity Consultative Council held last week under the chairmanship of Mr. I. J. Hayward, the London Electricity Board's policy regarding assisted wiring and hire-purchase was explained. It was stated that the question had been examined on a national basis and it had been decided that under existing circumstances assisted and other forms of rental wiring should be suspended indefinitely. In consequence, the limited operation of such schemes in the London Area had been suspended. Before vesting day most undertakings offered facilities for acquiring apparatus under extended credit schemes, which the Board had continued to operate. In addition, in order to meet the demand for similar facilities in districts where they were not previously available, the Board had introduced as an interim measure a hire-purchase scheme covering cookers, washing machines, refrigerators, and other major appliances. The period for repayment was limited to three years for the larger and more expensive appliances and one year for such items as vacuum cleaners. The London Board would be considering the whole problem of hire purchase, hire and assisted wiring in the light of the national policy decision, and the Consultative Council would be advised of any plans for modification or extension of the present facilities.

Mr. W. H. Warhurst, secretary of the Board, emphasized that the hire-purchase scheme did not apply to such equipment as fires, which might aggravate the peak-load position.

Power Plant Extensions

The consent of the Minister of Fuel and Power has been received by the British Electricity Authority to the establishment of new generating stations at Barrow-in-Furness (to be known as the Roosecote Marsh station) and East Yelland, near Barnstaple, and extensions at the North Tees (Co. Durham), Keadby (Lincolnshire) and Acton Lane (Willesden) stations. The first sections of the new stations will comprise two 30 MW turbo-alternators and two 300,000 lb/hr boilers at Roosecote Marsh; and two 30 MW sets and four 180,000 lb/hr boilers at East Yelland. The extensions consist of one 60 MW set and one 360,444 lb/hr boiler at North Tees; one 60 MW set and one 550,000 lb/hr boiler at Keadby; and one 30 MW set and two 240,000 lb/hr boilers at Acton Lane. Thus a total of 270 MW of generating plant is authorized.

The British Electricity Authority has

applied to the Minister of Fuel and Power for consent to the construction of a new generating station on a site of about 700 acres at Drakelow, in the rural district of Repton, near Burton-upon-Trent. It is designed for an ultimate capacity of 540 MW, the initial installation comprising two 60 MW sets and two 515,000 lb/hr boilers, with one concrete cooling tower.

Electricity in Lake District

Westmorland County Council has been told that the laying of underground electricity cables in the National Park area would be too costly. A joint conference of the Westmorland, Cumberland and Lancashire County Councils held earlier this year had agreed that the supplying of electricity to valleys and remote parts of the Lake Districts was essential, but that cables must be underground for scenic reasons.

Reduced Charges in Scotland

The South East Scotland Electricity Board announces that, as from the meter reading taken at the beginning of the forthcoming winter term, charges to domestic and commercial consumers will be reduced to 4½d per kWh for ordinary credit meters, and 5d per kWh for prepayment meters, in cases where the existing charges exceed these figures. The reduction will not apply in a few isolated cases where electricity is purchased at two or more "unit" rates, one of which is higher than 4½d or 5d as the case may be, but where the all-in cost is less than those figures. These reduced charges have been the subject of discussion with the S.E. Scotland Electricity Consultative Council, and the Board's decision to limit the additional charge for prepayment meters to ½d gives effect to a recommendation by the Council. About 16,000 consumers (12,500 domestic and 3,500 commercial) will benefit as a result of the introduction of the new rates.

Cooling Tower Nuisance

A meeting took place recently at Hull between representatives of the British Electricity Authority, the Ministry of Town & Country Planning and Hull Corporation to consider the nuisance caused by the concrete cooling tower at the Sculcoates power station. Hull Corporation Town Planning Committee has now issued a report of the meeting.

The divisional controller of the B.E.A. stated that his Authority was fully conscious of the nuisance and it was admitted that the Hull cooling tower was slightly worse than the average, although complaints were being received from almost every electricity undertaking which was employing these towers. A person with experience of cooling towers has been specially engaged by the B.E.A. and very expensive experiments were being carried out at the present time. The expert on cooling towers said he did not think that there was anything inherently wrong with the design of the tower and the possibility of remedying it was being investigated. Work was being done on the alteration of the basic design of towers at Croydon. It was in everyone's interest that the B.E.A. should be reasonably sure that modifications would be improvements before they were commenced. The towers were expensive to modify and only by research could it be found out how the nuisance might be prevented. The expert further stated that he had been engaged since January exclusively on the problem of improving the towers. The town clerk closed the meeting by stating that the results of the Authority's research would be awaited with interest but in the meantime it was expected that it would take all necessary steps to try to minimize the nuisance.

S.E. Board Sub-Area Changes

A NUMBER of Sub-Area changes are announced by the South Eastern Electricity Board. The headquarters of the Mid-Sussex Sub-Area is to be transferred to "Hawkridge," Church Road, Haywards Heath, although it will be some months before the move is completed. In the meantime Mr. H. Pryce-Jones, the Sub-Area manager , and his staff will remain at Electric House, Castle Square, Brighton.

Following the retirement of Mr. H. Dixon, M.I.E.E., manager of the Central Sussex District, Mr. A. M. Barker M.A.(Cantab), F.C.C.S., deputy Sub-Area manager, will, in addition, become Central Sussex District manager at Haywards Heath, as from 1st November.

The Brighton and Hove Districts will be amalgamated and known as the Brighton & Hove District, as from 1st November, with headquarters at Electric House, Castle Square, Brighton, and Mr. Pryce-Jones will relinquish the position of Brighton District manager, which he has held in addition to that of manager of the Mid-Sussex Sub-Area since vesting day. Mr. E. H. Skinner, M.I.E.E., deputy district manager, Central Sussex, will be manager of the new Brighton & Hove District as from 1st November, and Mr. F. Swarbrick, A.M.I.E.E., A.M.I. Mech.E., at present manager of the Hove District, will become deputy manager of the new combined district.

Mr. F. Lynn, A.M.I.E.E., deputy district manager, Brighton, becomes Sub-Area commercial officer as from 1st November.

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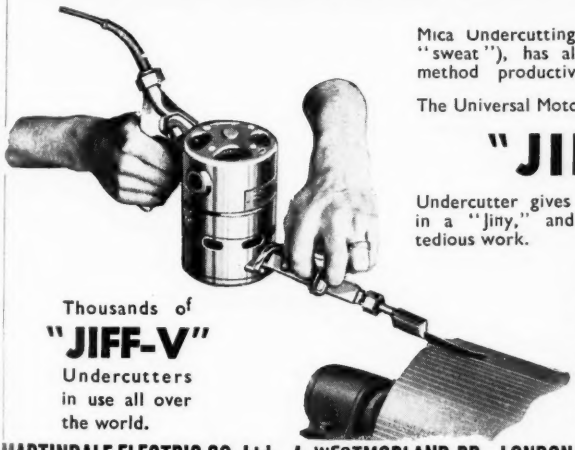

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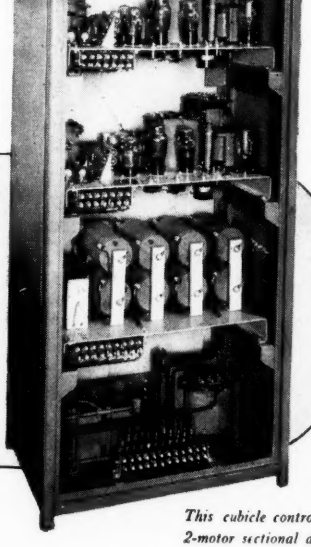

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NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1944

3032. British Thomson-Houston Co., Ltd.—Apparatus for placing articles on trays. 22nd February, 1943. (629944.)

18103. British Thomson-Houston Co., Ltd.—Liquid slip regulators for induction motors. 23rd September, 1943. (629885.)

1945

7547. British Thomson-Houston Co., Ltd.—Control circuits for low-pressure electric-discharge lamps. 29th March, 1944. (629886.)

18791. British Thomson-Houston Co., Ltd.—Rotary ironers. 27th July, 1944. (629888.)

1946

7838. Standard Telephones & Cables, Ltd.—Radio-navigation systems. 2nd October, 1944. (629947.)

10668. Standard Telephones & Cables, Ltd.—Radio direction finder. 9th April, 1945. (629948.)

17903. Tesch, W. J., and Darbo, H. H. (trading as Tesch & Darbo).—Snap-action electric switches. 11th July, 1945. (629949.)

19956. Marconi's Wireless Telegraph Co., Ltd.—Radio aerials. 4th July, 1945. (629893.)

22210. Bohus Mekaniska Verkstads Aktiebolag.—Electrode steam generators. 28th July, 1945. (629894.)

25698. Electro-Chemical Engineering Co., Ltd., and Smart, A.—Control of the current supply to electroplating vats. 28th August, 1946. (629895.)

32368. Batt, R. G. P.—Radar display systems. 31st October, 1946. (629953.)

32509. British Thomson-Houston Co., Ltd., and Moir, J.—Circuit arrangements employing thermionic valves. 1st November, 1946. (629954.)

33145. Casner Patents, Inc.—Self-starting hysteresis motor. 31st October, 1945. (629897.)

37550. Standard Telephones & Cables, Ltd.—Frequency convertor system. 12th March, 1946. (629825.)

1947

2475. Westinghouse Electric International Co.—High-frequency magnetron oscillation generators. 19th February 1944. (629902.)

4720. Park Royal Scientific Instruments, Ltd., and Davies, R.—Electric-discharge lamps. 18th February, 1947. (629958.)

6409. Bader, K. E.—Electric soldering-iron current supply rests, and the like. 7th March, 1947. (629959.

9018. Brun Engineering, Ltd., and Walton, J. L.—Electrical alarm systems. 2nd April, 1947. (629912.)

10239. Metropolitan-Vickers Electrical Co., Ltd., and Scoles, G. J.—Thermionic valve circuits. 17th April, 1947. (629907.)

12824. Crompton Parkinson, Ltd.—Rail vehicles and chassis therefor. 4th September, 1945. (629913.)

12880. Ekco Products Co.—Pressure cooker. 27th July, 1946. (629967.)

17804. Thompson Beacon Windows, Ltd., J., and Martin, A. E.—Electric welding machines for use in the manufacture of metal door and window frames or the like. 5th July, 1947. (629908.)

18848. Radio Corporation of America.—Apparatus for drying moisture laden articles by dielectric heating. 31st December, 1941. (629979.)

19304. Smith, E. S.—Means for forming sheathed electrical heating elements. 18th July, 1947. (629909.

19666. Electrolumination, Ltd., and Aldridge, J. F.—Support fittings for tubular electric gas discharge lamps. 22nd July, 1947. (629980.)

21845. Remington Rand, Inc.—Protector for an electric dry shaver. 6th November, 1942. (629712.)

23575. Every, C. E. (Titanium Alloy Manufacturing Co.).—Ceramic dielectric compositions. 26th August, 1947. (629713.)

23649. English Electric Co., Ltd., Woodford, C. G. A., and Ball, R. D.—Aircraft electric supply systems. 27th August, 1947. (629715.)

24019. Sangamo Weston, Ltd.—Integrating apparatus. 10th December, 1946. (629716.)

24650. Standard Telephones & Cables, Ltd., Gammie, J., and Jacobsen, B. B.—Arrangements for measuring the transmissions equivalents of electric communication channels. 8th September, 1947. (629718.)

24682. Wells, A. W. E.—Electrical switchgear such as isolating fuses. 8th September, 1947. (629911.)

24839. Pye, Ltd., and Lawson, D. I.—Modulating and amplifying arrangements for grounded grid amplifiers. 10th September, 1947. (629721.)

25076. Westinghouse Electric International Co.—Liquid-break electric circuit interrupters. 12th September, 1946. (629991.)

25208. Marconi Instruments, Ltd., and Wray, A. G.—Electrical measuring instruments. 15th September, 1947. (629723.)

26457. Westinghouse Electric International Co.—Dielectric heating. 4th October, 1946. (629995.)

27106. British Insulated Callender's Cables, Ltd., Holland, J., and Broom, T. C.—Splices for the overhead conductors of electric traction systems and splicing fittings therefor. 9th October, 1947. (629727.)

27266. Standard Telephones & Cables, Ltd., Henderson, H. S., and Blackwood, T. S.—Electric switching keys having inductor lamps. 10th October, 1947. (629997.)

27534. British Thomson-Houston Co., Ltd.—Electric capacitors and dielectric material therefor. 17th October, 1946. (629998.)

27851. Compagnie Générale d'Electricité.—Pressure-resisting water-tight box for electrical equipment. 10th December, 1946. (629999.)

27879. Maschinenfabrik Oerlikon.—Thermal power plant. 11th November, 1946. (630000.)

28629. General Electric Co., Ltd., and Friedlander, E. S.—Saturable reactor stabilising arrangements for a.c. systems. 27th October, 1947. (629829.)

28718. General Motors Corporation.—Automatic electric mercury circuit interrupters. 1st November, 1946. (629830.)

29252. Aktiebolaget Ljungstroms Angturbin.—Gas turbine power plants. 2nd November, 1946. (629832.)

29524. British Thomson-Houston Co., Ltd.—Internal exhaust seals for electric lamps and similar devices. 9th November, 1946. (629833.)

30136. British Thomson-Houston Co., Ltd.—Transformer coil supports. 14th November, 1946. (629733.)

30164. Blackband, W. T.—Multi-contact electrical connectors. 12th November, 1947. (629734.)

30204. Allmanna Svenska Elektriska Aktiebolaget.—Disconnecting switch for high-tension electrical circuit-breakers. 16th November, 1946. (629839.)

30211. Reyrolle & Co., Ltd., A., Young, A. F. B., Geeson, C. T., and Gray, W.—Temperature responsive devices for the protection of polyphase electrical systems. 13th November, 1947. (629736.)

30225. Becker, C. A.—Electric torches. 13th November, 1947. (629737.)

30256. Cole, Ltd., E. K., and Stickley, W. A.—Circuits for the starting and operating of discharge lamps. 14th November, 1947. (629840.)

30271. Standard Telephones & Cables, Ltd., and Pheazey, J. R.—Electric communication cable. 14th November, 1947. (629740.)

30309. General Electric Co., Ltd., and Harrison, W. J. D.—Method of manufacturing electric conductors provided with glass beads. 14th November, 1947. (629742.)

30314. British Thomson-Houston Co., Ltd.—Temperature recording devices. 27th November, 1946. (629744.)

30359. Parolle Electrical Plant Co., Ltd., and Anderson, E.—Contact arrangements for air-break electric switches. 15th November, 1947. (629748.)

30398. Anderson, Boyes & Co., Ltd., and Anderson, A.—Electric cable plug-and-socket connectors. 15th November, 1947. (629750.)

30451. Line Equipment, Ltd., and Jackson, H. P.—Fusible electric cut-outs. 17th November, 1947. (629752.)

30490. General Electric Co., Ltd., and Miles, E. E.—Electric-discharge lamps. 17th November, 1947. (629754.)

30538. British Thomson-Houston Co., Ltd., and Wood, C. W.—Electric lamp holders. 18th November, 1947. (629756.)

30540. British Thomson-Houston Co., Ltd.—Cemented carbide body having a soft metal insert and a method for securing the insert therein. 20th November, 1946. (629757.)

30762. Harski, I.—Combined electric hand torch and theft or like alarm. 20th November, 1947. (629842.)

30775. British Insulated Callender's Cables, Ltd., and Hollingsworth, D. T.—Marking of metallic joints between metal articles. 20th November, 1947. (629767.)

31180. English Electric Co., Ltd., and Deriaz, P.—Overspeed brakes for hydraulic turbine runners. 25th November, 1947. (629776.)

31537. Patterson, C. A., and Smith, F. C.—Electrical measuring equipment and electrical brush gear therefor. 28th November, 1947. (629788.)

31694. Krebs, E. W.—Electromagnetic eddy-current couplings. 1st December, 1947. (629919.)

31705. General Electric Co., Ltd., and Caldwell, J. T.—Mechanisms adapted to support objects for rotational movement. 1st December, 1947. (629790.)

31714. Constantine, T.—Position indicators for electric wall switches. 1st December, 1947. (629791.)

31741. British Transport Commission, and Dell, R.—Electric cables. 1st December, 1947. (629793.)

31767. Westinghouse Brake & Signal Co., Ltd., Sheppard, E. A., and Glover, B. W.—Manufacture of alternating electric current rectifiers. 2nd December, 1947. (629795.)

32014. D.P. Battery Co., Ltd., and Brown, H. G.—Lead-acid accumulators. 4th December, 1947. (629921.)

32067. General Electric Co., Ltd., and Caldwell, J. T.—Locking devices. 4th December, 1947. (629922.)

32078. Poole R.—Electric cables. 4th December, 1947. (629923.)

32212. Pye, Ltd., and Hawke, K. N.—Process for cleaning insulated wires. 6th December, 1947. (629926.)

32293. Rockweld, Ltd., Boag, D. J. W., and Hamilton, J. L.—Electrode holders for oxy-electric cutting of metal. 8th December, 1947. (629806.)

32374. Telegraph Construction & Maintenance Co., Ltd., Smith, E. W., and Presswell, R. W.—Housings for submarine cable repeaters. 8th December, 1947. (Addition to 619424.) (629761.)

32593. Philips Electrical, Ltd.—Electrical terminals. 5th October, 1946. (629813.)

32826. Dubilier Condenser Co. (1925), Ltd. (Dubilier, W.).—Vents for electrolytic condensers. 12th December, 1947. (629820.)

32882. Electro-Hydraulics, Ltd., and Hunter, A.—Pushbutton electric switches. 12th December, 1947. (629821.)

32980. Philips Electrical, Ltd.—Frequency control circuit arrangements. 20th September, 1946. (Addition to 607798.) (629929.)

33670. British Thomson-Houston Co., Ltd.—Electric wave transmission systems. 15th October, 1943. (629861.)

33800. Standard Telephones & Cables, Ltd.—Circuit arrangement in keyed control oscillators. 20th July, 1943. (629865.)

33834. British Thomson-Houston Co., Ltd.—Separating impulses of different durations. 27th February, 1945. (629866.)

34065. British Thomson-Houston Co., Ltd.—Selenium rectifiers and methods of making the same. 26th December, 1946. (629869.)

34744. Morgan Crucible Co., Ltd., and Lyddon, P. E.—Sandwich commutator brushes. 24th December, 1947. (629939.)

34634. English Electric Co., Ltd., and Lyddon, J. O. P.—Gas turbine-driven locomotives. 29th December, 1947. (629875.)

34378. Aktiebolaget Elektrolux.—Speed regulating device for electric motors. 12th September, 1944. (629941.)

34750. General Electric Co., Ltd., and Dovey, D. M.—Carburization of iron and iron alloys. 30th December, 1947. (629879.)

34757. Adamant Engineering Co., Ltd., and Matravers, F. G.—Switch mechanism for operating electric horns on vehicles. 30th December, 1947. (629880.)

35179. Philips Electrical, Ltd.—Electric-discharge tubes comprising secondary emission electrodes. 6th June, 1939. (629881.)

35193. Philips Electrical, Ltd.—Amplifying circuits for ultra-short waves. 19th June, 1940. (629882.)

35200. Philips Electrical, Ltd. — Super-regenerative radio receiving circuits. 26th April, 1939. (629883.)

Amended Specifications

588185. Wright, C. S., and others.—High-frequency electric oscillators.

596248. Bendix Aviation Corporation.—Carbon pile electric regulator.

601470. Westinghouse Electric International Co.—Electric elevator control systems.

610109. Lucas, Ltd., J., and another.—Terminals for electric cables.

Trade Marks

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered within a month of 12th October.

TRANSTAR. No. 664,113. Class 9. Apparatus embodying electric transformers and choke coils for use in starting and controlling electric discharge lamps.—Inductive Appliances, Ltd., 18, Dean Street, Newcastle-on-Tyne.

PROSCON. No. 675,676. Class 9. Electrical apparatus and instruments and parts. No. 675,677. Class 11. Electrical apparatus, fittings and appliances for lighting, heating, steam generating, cooking, refrigerating, drying, ventilation purposes, etc., and parts.—Process Control Gear Ltd., 56, Victoria Street, St Albans, Herts.

VITCARB. No. B677,249. Class 9. Electric resistances made of carbon.—Vitcarb, Ltd., Vitcarb Works, Springfield Walk, Kilburn, London, N.W.6.

POLVAC. No. 677,683. Class 9. Electric domestic polishing machines.—J. M. Glauser & Sons, Ltd., Bridge Buildings, Benshaw Manor Road, Thornton Heath, Surrey.

WOBBULATOR. No. 678,676. Class 9. Signal generators for radio and television purposes.—P. H Samwell and T. G. Hutton, trading as Samwell & Hutton, Combine Works, 1, Goodmayes Road, Ilford, Essex.

ROMAC. No. 679,247. Class 9. Television and wireless receiving and transmission apparatus and instruments, and parts.—Romac Industries, Ltd., Romac Works, The Hyde, Hendon, London, N.W.9.

HELIKON. No. 674,382, and HELICON. No. 675,796. Class 11. Electric lamps.—Helikon, Ltd., 234, Bishopsgate, London, E.C.2.

SCEMROLA. No. 679,223. Class 11. Lighting apparatus and lighting fittings.—Scemco, Ltd., 6-7, Soho Street, London, W.1.

CELTA. No. 678,174. Class 14. Clocks.—Hotpoint Electric Appliance Co., Ltd., Crown House, Aldwych, London, W.C.2.

CONTRACT INFORMATION

ACCEPTED TENDERS AND PROSPECTIVE ELECTRICAL WORK

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section, the date of the issue is given in parentheses.

Australia.—SYDNEY.—9th February. County Council. Generating plant for Lugarno power station. (C.R.E. (I.B.) 28137/49. Ten/689.)*

MELBOURNE.—2nd November. Victoria State Electricity Commission. One 30-ton electric travelling crane. (See this issue.)

Belgium.—CITY OF ANTWERP.—22nd December. Electric street lighting installation at docks. (C.R.E. (I.B.)) 18001/49. Ten/690.)*

Brazil.—PORTO ALEGRE.—9th January. State Commission for Electric Energy. Hydro-electric power plant at Santa Rosa. (C.R.E. (I.B.) 27419/49. Ten/688.)*

Denbighshire.—Education Authority. Heating and domestic hot water installation and electric lighting installation at Brynhyfryd Grammar School. (14th October.)

Dundee.—21st November. North of Scotland Hydro-Electric Board. 33 kV cables. (See this issue.)

Frimley and Camberley.—31st October. U.D.C. Street lighting installation. (14th October.)

Hexham.—R.D.C. Installation of electricity in twenty-six houses at Acomb. R. C. Heslop, surveyor, Prospect House.

Llangefni.—Anglesey County Education Committee. With regard to the advertisement in last week's issue inviting tenders for the electrical installation at the new Amlwch county secondary school, the time for receipt of deposits has been extended to 31st October and the last date for submission of tenders to 14th November.

Luton.—7th November. Town Council. Electrical installations at Ashcroft Road Infants' School. (14th October.)

Manchester.—31st October. Health Committee. Rewiring of electrical installation at Langho Colony. (See this issue.)

Merton and Morden.—4th November. U.D.C. Street lighting installations. (14th October.)

Middlesex.—26th October. County Council. Supply of electric lamps. (14th October.)

Newcastle-on-Tyne.—City Council. Installation of fluorescent lighting at the welfare offices in Pilgrim Street. City estate and property surveyor, Town Hall.

Northallerton.—North Riding County Council. Additions to lighting installation at the County Hall. (See this issue.)

Northumberland.—County Council. Electrical installation in kitchen and dining-room at Whitley North School, Whitley Bay. County architect, County Hall, Newcastle-on-Tyne.

Peterborough.—Joint Education Board. Electrical installations in schools. (14th October.)

Portsmouth.—City Council. Renewal of electrical installation on South Parade Pier. (See this issue.)

Southport.—14th November. Street Lighting Department. Electric lamps. (See this issue.)

Swindon.—Wilts County Council. Rewiring of Technical College. (See this issue.)

Uruguay.—MONTEVIDEO.—18th November. Usinas Electricas y Telefonos del Estado. Supply of 19,500 fuse plugs. (C.R.E. (I.B.) 28057/49. Ten/718.)*

West Hartlepool.—Town Council. Installation of electricity in twenty-four houses on the Rift House estate. Borough architect.

Orders Placed

Liverpool.—Education Committee. Rewiring Liverpool Collegiate School.—Winstanley & Lambert, Ltd. (£2,598).

Newcastle-on-Tyne.—City Council. Supply of 145 lighting standards (£2,496).—Revo Electric Co. 145 sodium lanterns, transformers and capacitors for street lighting (£1,804).—G.E.C. Electrical repairs to council houses for six months (£220).—Bernard Berrie. 50 kW 240 V d.c. loading resistor for turbo-alternator and one floor-mounting control panel (£325).—Rheostatic Co. One Farnboro electric indicator and equipment (£374).—Dobbie McInnes, Ltd.

Northumberland. — Education Committee. Electrical installation in connection with alterations to Alnwick Training College (£357).—I. and E. Morton.

Sunderland.—Town Council. Electric cooking equipment at Milton Hall (£180).—G.E.C.

West Hartlepool.—Corporation. Supply of 52 street lighting sets (£761).—Metropolitan-Vickers.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alfreton.—Factory, Nix Hill, for Cellular Clothing Co., Ltd.; W. V. Betts & Son, architects, 2, St. Peter's Church Walk, Nottingham.

Bedford.—Houses (100), Aylesbury Road; H. C. Janes, Ltd., builders, 183, Hightown Road, Luton.

Bedlington.—Pithead baths at Netherton Howard Colliery; divisional architect, Miners' Welfare Commission, Queen Square, Newcastle-on-Tyne.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Thames House North, Millbank, S.W.1. Victoria 9040.

Bristol.—Extensions to University; Sir George Oatley, architect, 12, Gt. George Street.

Bury.—Elton secondary school (£82,331); James Hobson & Sons, Nottingham.

Cheshunt.—Houses (98) for Edmonton B.C.; architect, Town Hall, Edmonton, N.9.

Chester.—Works and offices, Sealand Trading Estate; Knutsford Motors, Ltd., Garden Road, Knutsford.

Crayford.—Factory and offices; Frederick Braby & Co., Ltd., galvanized steel manufacturers, Euston Road, London, N.W.1.

Croydon. — Fairchilds secondary modern school (£179,000); C. T. Ayerst, architect, 38, High Street.

Derby.—Cottage homes estate; Linen and Woollen Drapers' Institution, Hammers Lane, London, N.W.7.

Exeter.—Police station and houses, Whipton Barn estate and secondary modern school, Priory estate; city architect.

Gellygaer.—Omnibus garage, Tir-y-Berth, for U.D.C.; Clifford Tee & Gale, architects, 43, Frederick Road, Birmingham.

Glasgow.—New classrooms, etc., at school for deaf (£60,000); Pringle, Lockerby & Sproul, surveyors, 261, West George Street.

Glyncorrwg.—Houses (80); U.D.C. surveyor.

Hampshire.—Schools at Andover and Ashley New Milton; county architect, The Castle, Winchester.

Hexham.—Houses (22), Stocksfield, for R.D.C.; J. H. Newman & Sons, builders.

Houghton-le-Spring.—Houses and cottages for aged persons; R.D.C. surveyor.

Ilford.—Factory and offices, Sunnyside Road; Bradley & Burch, Ltd., tinplate merchants, King William Street, London, E.C.4.

Seven-storey block of 38 flats, Beehive Lane; borough engineer.

Houses (49), Havering Gardens; E. Meredith, architect, 6, Victoria House, High Road, Goodmayes.

Ipswich.—Houses (122), Maidenhall Estate, in two contracts; J. G. Barr, town clerk, Town Hall.

Kidderminster.—Divisional police headquarters, Mason Road; county architect, 60, The Tything, Worcester.

Houses (64), Sion Hill estate; borough surveyor.

Factory; Morris & Co. (Kidderminster), Ltd., Hoobrook Mill.

Kingston-on-Thames.—Crematorium at Cemetery; borough engineer.

"Gregory" type flats (144), Chessington site; Gee, Walker & Slater, Ltd., builders, 100, Park Lane, W.1.

Leeds.—Warehouse and factory, Sweet Street; J. Lyons & Co., Ltd., Cadby Hall, Hammersmith, London, W.

Leicester.—Schools at Lutterworth and Loughborough, and science block at Loughborough College; T. A. Collins, county architect, County Offices, Grey Friars.

Junior and infants' school, New Park estate; G. Calverley & Sons, Ltd., Evington Valley Road.

Lincolnshire. — Infants' school (Bushfield Road), junior school (Lincoln Gardens), and technical institute, Scunthorpe; secondary modern schools, Coningsby and Spilsby, and junior school, Horncastle; county architect, Lincoln.

Litherland. — Community and shopping centre, Kirkstone Road North area (£91,000); G. Ponsford, surveyor, Town Hall, Litherland, Liverpool, 21.

London.—Proposed hotel (100 beds), Tavistock Square, W.C.1; Imperial London Hotels, Ltd., Russell Square, W.C.1.

BERMONDSEY.—Four blocks of dwellings, Staples Rents area; H. V. Ashley & Winton Newman, architects, 3, Verulam Buildings, Gray's Inn, W.C.1.

LEWISHAM.—Works, Jerrard Street; Blanchard Bros., 24, Havelock Walk, S.E.23.

STOKE NEWINGTON.—Flats (80), Green Lanes; Howes & Jackman, architects, 1, Verulam Buildings, Gray's Inn, W.C.1.

Morpeth.—Installation of electric lighting and power at girls' grammar school; W. W. Tasker, county architect, County Hall, Newcastle.

Newbury.—Block of 26 flats, Craven Road; borough surveyor.

Newcastle-on-Tyne.—Houses (12), St. Cuthbert's Road; Rochester & Kirk, Ltd., builders, Lanercost Drive.

Milk heating and preparation factory for Newcastle Dairymen's Association; R. Burke, 10, Lambton Road, Newcastle.

Northampton.—Infants' School, Gladstone estate; borough architect.

Northumberland.—New county mixed school at South Farm, Blyth (£120,000); county architect.

Nottingham.—Restaurant, etc. (five-storey), Beastmarket Hill; C. B. & W. H. Truman, Ltd., 6, Beastmarket Hill.

Oswestry.—Houses (12), St. Martin's, for R.D.C.; F. Roberts & Son.

Peterborough.—Houses or flats, Eastfield estate; city engineer.

South Shields.—Secondary technical school near Lisle Road; J. Wilks, architect, 72, Sunderland Road.

Stalybridge.—Houses (70), Buckton Vale estate; Howard & Benson, architects, 88, Mosley Street, Manchester.

Standish.—Houses (18), Coronation Road site; U.D.C. surveyor.

Stockport.—School, Didsbury Road, Heaton Mersey; E. G. Thomas, director of education, Education Offices, Town Hall.

Stokesley.—Houses (16), North Road, for the R.D.C.; Bailey & Son, builders, Denmark Street, Middlesbrough.

Sunderland.—Methodist Church and schoolroom, Ettrick Grove (£10,000); Rev. A. E. Fletcher, minister-in-charge, 10, Beechwood Street.

Additions to technical college; education architect, Stockton Road.

Secondary school at Hill View; W. & T. R. Milburn, architects, 17, Fawcett Street.

Twrcelyn.—Houses (42), on various sites; T. Alwyn Lloyd, architect, 6, Cathedral Road, Cardiff.

Tynemouth.—Canning factory, Clive Street, for Tyneside Butchers By-Products, Ltd.; Tasker & Child, architects, New Bridge Street, Newcastle-on-Tyne.